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Tone Orthography and Literacy

The voice of evidence
in ten Niger-Congo languages

EDITED BY
David Roberts
and Stephen L. Walter



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Radboud University Nijmegen

Paul van den Broek
Leiden University

Volume 18

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The voice of evidence in ten Niger-Congo languages
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Edited by

David Roberts

Independent scholar

Stephen L. Walter

Dallas International University

John Benjamins Publishing Company

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Foreword

In this eye-opening tour de force, Roberts, Walter and their colleagues take us on a guided tour of a world far removed from the air-conditioned comfort of the prototypical hi-tech university laboratory where most Western psycholinguists and cognitive psychologists conduct their research. WEIRD (Western, Educated, Industrialized, Rich, Democratic; Henrich et al. 2010) reading science continues to dominate the field of literacy with almost all the major theories and models of reading and reading pedagogy still founded on research with highly atypical but highly “convenient” samples of university undergraduates. These privileged monolingual English-speaking samples, who have learnt to read in their native tongue, have been immersed since birth in a print-rich milieu with a long-standing and well-institutionalized culture of literacy and literature that makes reading an omnipresent, almost inescapable fact of life.

In stark contrast, the authors of this volume usher us into the developing world of West Africa, and the formidable (but not insurmountable) challenges of undertaking experimental research in “inconvenient” non-WEIRD settings. They introduce us to primarily oral cultures still struggling to establish literacy, where the Roman script is being adapted to the needs of indigenous tone languages. Here, technology is the blackboard and chalk, internet connections are poor and erratic, telephone networks unreliable, most classrooms have intermittent or no electricity, and some classes are held under a mango tree. Albeit highly motivated, the research participants too present novel challenges unknown to WEIRD reading science. Recording basic demographic data is complicated by the absence of birth documentation (a literate invention), multiple languages and dialects within an extended family, years of schooling confounded by erratic attendance and the custom of repeating a grade if children fail end-of-year exams. Even recording a participant’s name is no simple matter because many Africans use different names in different domains of their lives – at home, at work, at church, and on official documents.

In this context, the authors pose the question: *To what extent does full tone marking – the standard practice in all languages investigated – contribute to oral reading fluency, comprehension and writing accuracy, and does that contribution vary from language to language?* In a world still fighting hard against pseudo-scientific and anti-scientific practices in medicine, psychology and education, the contributors

to this volume show that even in such non-WEIRD settings, scientific methods can be trusted to shed light on untested intuitions, “hunches” and “anecdotes”, and offer informed advice to local decision-makers about the best evidence-based practices.

The authors take as their point of departure the ground-breaking single-setting studies by Bird (1999) and Bernard et al. (2002). But because no single experiment in science, however “elegant”, is definitive, evidence must be independently replicated across settings, languages, writing systems and cultures in the quest for convergence. Roberts and Walter’s research team takes a huge step forward by examining the impact of full tone marking in no fewer than ten Niger-Congo languages representing four language families and five countries. They tackle this question by drawing on the best and most advanced tools and methods of empirical science – systematic and methodical data collection and analysis. Advanced statistical techniques are employed as a *means* (not an end) to understanding the data. Part 1 provides a thorough and penetrating linguistic and orthographic analysis of each of the ten languages under investigation, their orthographies, teaching methods and materials, and ethno-literacy backdrop. Part 2 presents the experiment results preceded by an introduction to each of the reading and writing constructs and measures used to assess the impact of full tone marking – reading speed, accuracy, comprehension and writing accuracy. Surprisingly for this day and age of professional and academic specialization, the authors demonstrate equally impressive scholarship in the disciplines of linguistics, cognitive and educational psychology, educational practice and pedagogy. The introductory sub-sections in Part 2 on the reading and writing measures could well serve as a highly readable tutorial introduction to these constructs and their measurements. The survey and analysis of the literacy primers and transition guides used to teach each orthography also shows a deep understanding of pedagogical best practices, dissecting the strengths and weaknesses of these materials and offering specific practical recommendations for improvement. It must be acknowledged that when most linguists venture outside their speciality into behavioral science, or vice versa, the result is often disjointed and amateurish. The contributors to this volume have accomplished the rare feat of presenting a rich inter-disciplinary tapestry which interweaves insights from linguistics, writing systems research, psychology and education into a coherent narrative.

As often happens in real science, the authors discover that intuition and common sense can be plain wrong when examined systematically and rigorously. The research findings challenge (in most, but not all of the ten languages) not only the widespread practice of full tone marking in Africa, but also many preconceptions of WEIRD reading science such as the difficulties associated with measuring words-per-minute when comparing reading rate across languages, the relationships between orthographic depth and efficiency, and the linkage between speed, accuracy, and comprehension within and across L1 and L2 reading.

Above all, this volume serves as a caveat for contemporary WEIRD reading science, still tethered to the most affluent and literacy-privileged populations, that the broader socio-cultural and historical context of literacy cannot be ignored. In the developing world, ethno-literacy variation is profound and has a massive impact on literacy, one that dwarfs the text-level and word-level variables that monopolize most of the WEIRD research agenda.

For a work of thorough and uncompromising scholarship, this volume is exceptionally well written. Following the “best practices” of evidence-based scientific discourse, almost every statement is backed up with citations to the relevant literature. And, in the best traditions of objective, disinterested scientific inquiry, the authors maintain a balanced and impartial stance, reporting and weighing the implications of their findings with admirable candidness and open-mindedness. Like much scientific inquiry, this study raises more questions than it answers, while offering sage advice for future orthography research and pedagogy.

Professor David L. Share

Head of the Literacy and Writing Systems Laboratory,
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About the authors

Ginger (Virginia Lee) **Boyd** is an SIL linguistics consultant working in Cameroon and neighboring countries. In 2015, she obtained a PhD in African linguistics from Leiden University. She has worked in a wide variety of African language families including Chadic, Bantoid, Bantu, and Ubangian. Her professional interests range from phonology, tonology and orthography development to morphosyntax and text analysis.

Matthew Harley is a linguistics consultant for SIL Nigeria and the associate international linguistic coordinator for SIL International. In 2005, he obtained a PhD from SOAS University of London with a description of the Tuwuli language of Ghana, and he has since worked on various Ghanaian and Nigerian languages. His main research interests are the comparative phonology, orthography and morphosyntax of Nigerian languages.

Johannes Merz is a senior anthropology consultant with SIL International and SIL Togo-Benin. He holds a PhD in cultural anthropology from Leiden University and has published numerous articles in the area of anthropology and media. He is currently working on expanding the Mbelime-French dictionary.

JeDene Reeder works as a senior literacy and education consultant with SIL International in West Africa. She has also worked with SIL in the Democratic Republic of the Congo. She obtained an EdD in 2011 from Simon Fraser University, Canada, and an MA in linguistics in 1998 from the University of Texas at Arlington. She has presented papers at several Pan-African Conferences on Reading for All (now Literacy for All). Her most recent publications are a book on leadership and capacity building in literacy, and a description of Pagibete, a Bantu language of D.R. Congo.

David Roberts (principal investigator) is an independent linguistics, literacy and education consultant based in Togo. In 2008, he obtained a PhD in African linguistics from INALCO, which he followed with two postdoctoral fellowships at the LLACAN-CNRS research laboratory in Paris. He is the author of numerous articles on tone and tone orthography as well as two books on the Kabiye language.

Valentin Vydrin is professor of Manding at INALCO, a researcher at LLACAN-CNRS in Paris, and professor at St. Petersburg State University. He is the author of numerous publications on various Mande languages.

Stephen L. Walter is an associate professor in the department of applied anthropology at the Dallas International University, Texas. He has a PhD in linguistics from the University of Texas at Arlington (1980). He teaches courses on language in literacy and education and research methodology. His current research focuses on language development and the role of language in educational processes including work done for the World Bank, UNESCO and UNICEF.

Andy Weathers works as a linguist with SIL International in Togo. He has a Masters in Applied Linguistics from Biola University. His professional interests include the development of Ajami (Arabic script) orthographies for African languages, and of specialized Android keyboards for writing African languages on mobile devices and social media platforms.

Abbreviations

| | |
|------|--|
| AGE | agentive |
| APP | applicative – valence increasing (Elip, Mmala, Yangben) |
| ASS | associative marker |
| ATR | advanced tongue root |
| C | consonant |
| C1 | noun class 1 (and similarly for other classes) |
| CJT | conjoint series of pronominal predicative markers (Eastern Dan) |
| CMU | noun class mu- (Elip, Mmala, Yangben) ¹ |
| CND | conditional |
| CNJ | conjunction |
| CNT | continual |
| CST | causative |
| DET | detransitive extension (Elip, Mmala, Yangben) |
| DIM | diminutive |
| EXC | exclusive |
| EXI | existential series of pronominal predicative markers (Eastern Dan) |
| EXT | frozen extension (Elip, Mmala, Yangben) |
| FOC | focalizer |
| FUT | future |
| FUT1 | near future (Elip, Mmala, Yangben) |
| FUT2 | distant future (Elip, Mmala, Yangben) |
| FV | final vowel (Elip, Mmala, Yangben) |
| H | high tone |
| HAB | habitual |
| IMP | imperative |
| INC | inclusive |
| INF | infinitive |
| IPF | imperfective |
| IZF | izafet – head marking of nominal dependency (Eastern Dan) |
| L | low tone |
| LOC | locative |
| LOG | logophoric pronoun (Eastern Dan) |

1. This is the typical non-diminutive plural of C19 in Mbam languages considered by Guthrie (1971: 32) to be extraneous and therefore not assigned a class number.

| | |
|------|--|
| M | mid tone |
| N | nasal |
| NC | noun class |
| NEG | negative |
| NEU | neutral |
| NOM | nominalization marker (Eastern Dan) |
| NSJ | non-subject pronominal (Eastern Dan) |
| OBJ | object |
| PST1 | past – recent or anterior (Elip, Mmala, Yangben) |
| PST2 | past – earlier today (Elip, Mmala, Yangben) |
| PST3 | past – yesterday (Elip, Mmala, Yangben) |
| PST4 | past – before yesterday (Elip, Mmala, Yangben) |
| PER | perfective |
| PL | plural |
| POS | positional extension (frozen) |
| PRS | present |
| PX | prefix |
| REF | reflexive pronoun (EASTERN DAN) |
| REL | relative |
| SBJ | subject |
| SBV | subjunctive series of pronominal predicative markers (EASTERN DAN) |
| SG | singular |
| SP | subject pronoun |
| SUB | subordinate marker |
| SVO | subject-verb-object |
| SX | suffix |
| T | tone |
| TAM | tense, aspect, mood |
| TBU | tone bearing unit |
| V | vowel |
| VB | verbal marker |
| XH | extra-high tone (EASTERN DAN) |
| XL | extra-low tone (EASTERN DAN) |

Introduction

Introduction

(David Roberts, Johannes Merz, JeDene Reeder)

1. Background and aims

It is not uncommon for the newly emerging orthographies of tone languages to mark tone fully, which, in the African context, usually means marking one fewer tones than the number of phonemic tones in the language. Yet it is no exaggeration to say that, after well over a century of orthography development in such languages, not a shred of empirical evidence has yet emerged from quantitative experimentation confirming that full tone marking is a viable strategy, neither in terms of enhancing speed, accuracy, and comprehension in oral reading performance, nor in terms of developing competent writers. Indeed, not even any well-defined methodological or experimental standards exist to help judge whether, how, and how much tone should be marked in an orthography. Most newly developed tone orthographies are based only on descriptive phonological analysis; few linguists venture into the classroom itself to investigate the performance of learners in oral reading and writing.

One benefit of the enormous acceleration in tone research over the last fifty years has been a growing awareness of how vastly different one tone system can be from another, and this includes its functional load (Lüpke, 2011, p. 332). So it could be that for some languages full tone marking may be unavoidable, while for others such a strategy would be overkill. Discussions of this sort, even among experienced fieldworkers, tend to be dominated by hunches and anecdotes.

Two classroom experiments, in Dschang (Bird, 1999b) and Kom (Bernard et al. 2002),¹ are notable exceptions to this unfortunate state of affairs and they have had considerable influence since their publication. Both authors present empirical evidence that the existing full tone orthographies in these languages actually hinder fluent reading and writing. These were also the first experimenters in the tone orthography literature to apply a rigorous statistical methodology, carefully tracking the impact of a range of independent variables, and validating their results with reference to statistical probability. Moreover, Bird was the first to highlight certain concepts that have since found their way into the vocabulary of tone

1. Bernard et al. (2002) was preceded by a single-subject experiment in the same language (Bernard et al. 1995).

orthography developers, such as tonal stability (Kutsch Lojenga, 2014), diacritic density (Roberts, 2009), and orthographic depth (Snider, 2014). We are not going to attempt a detailed evaluation of these earlier tone orthography experiments, as the ground is already covered (Roberts, 2008).

However, these two experiments need to be put in perspective. Dschang and Kom are both Grassfields languages of Cameroon, so they provide only a narrow window onto the question of tone marking. Neither Bird nor Bernard et al. ever claim that these two languages are in any way representative of Africa's rich linguistic diversity. Furthermore, the experiments were undertaken with very limited samples (11 Dschang speakers and 13 Kom speakers, respectively). For the past two decades, there has been a pressing need to multiply the kind of data that Bird and Bernard et al. had the perspicacity to make available, in order to provide a more comprehensive picture of the effects of full tone marking on reading and writing performance.

That is the aim of this book: It reports the results of ten quantitative classroom experiments that closely replicate Bird's design in ten Niger-Congo languages (henceforth "the focal languages"), representing four language families and five countries. In this way, it will contribute to the goal of helping all who are developing orthographies for tone languages, in Africa and elsewhere.

The cross-linguistic nature of our research is crucial, because all the existing tone orthography experiments tackle only one language at a time, and since each of them employs a different methodology, comparison between the results is difficult. Our approach also places a strong emphasis on cross-disciplinary research, in particular promoting writing systems research, the cognitive psychology of reading, educational research, and sociolinguistics as having potential for illuminating tone orthography practice, in addition to the purely phonological considerations that have tended to dominate the literature.

Our research carries no assumption that zero and full tone marking are the only available options. It is probable that for many African languages partial marking would be more suitable, or that, in others, it would be more appropriate to mark grammatical tonal contrasts than to mark tone phonographically. We do not investigate those possibilities here. Instead, we limit ourselves to a more general research question which is exploratory in nature: *To what extent does full tone marking contribute to oral reading fluency, comprehension, and writing accuracy, and does that contribution vary from language to language?*

In order to explore the research question in any depth, it will be helpful to first stand back and examine the ethno-literacy context (Rogers & Street, 2012, pp. 62–63), that is, the ethnographic study of the cultural and social challenges that are distinctive to undertaking experimental orthography research in the African context.

2. Experimental orthography research in Africa

Most reading research is conducted on what Henrich, Heine, and Norenzayan (2010a, 2010b) term WEIRD participants (Western, Educated, Industrialized, Rich, Democratic). It is simply more convenient and economic for psychologists to recruit under-graduates in their own departments as research subjects or for the more adventurous to conduct an experiment in a local primary school. The authors plead for experimental linguistics to intentionally broaden its scope to include subject pools that are not WEIRD, with a view to representing the full range of human experience.

The series of experiments reported in this book is a direct response to Henrich et al.'s rallying cry. They were conducted in rural and urban West Africa, working with non-Western participants most of whom have relatively low levels of formal education, are living in largely non-industrialized societies, are relatively poor, and whose history with democracy is relatively recent. In sum, these societies are a long way from being WEIRD.

How does this unusual social environment compare and contrast with Henrich et al.'s WEIRD norm? We will identify various challenges involved in undertaking experimental research in Africa that are distinctive to the milieu: challenges having to do with the linguistic context (Section 2.1), the literacy context (Section 2.2), the social context (Section 2.3), and the researchers' own objectives (Section 2.4).

2.1 Linguistic context

Experimental research on the psychology of reading has traditionally focused on the major European languages, with the lion's share oriented towards English, even though its orthography is, in many respects, an outlier (Share, 2008). Nothing shows this domination more clearly than the fact that when the language under investigation is not even specified, it is generally assumed to be English (Share, in press). Recent years, however, have seen some healthy diversification with experimental research emerging on languages such as Hebrew (e.g. Ibrahim et al. 2013), Arabic (e.g. Abu-Rabia, 1997), Japanese and Korean (Park & Vaid, 1995) and, with particular reference to tone, Thai (Winskel & Perea, 2014; Winskel et al. 2017), and Mandarin (Wiener & Ito, 2015). We will return to discuss some of these in more detail later. The point to note here is that, in spite of the welcome diversification in the recent literature, it is still focused on majority languages. Those with smaller populations are much less visible in the world of reading research, notwithstanding some recent contributions on Shona (Kadyamusuma & Kadenge, 2013), Hmong Daw (Vitrano-Wilson, 2016), Dholuo and Gikuyu (Piper et al. 2016).

Africa is home to over 2000 of the world's estimated 7000+ languages (Eberhard et al. 2020). Population sizes range from a few dozen to several million. Most African languages are politically marginalized, because the governments of the countries where they are spoken may accord them no official status or, if they do, only pay lip service to their need for development. Some of them are endangered, although Africa is proving surprisingly resilient on this score in comparison with other continents. Most of the focal languages in which we undertook experiments are spoken in a wide range of social settings by all ages and are being passed on orally from one generation to another. The experiments bring data to the table from marginalized minorities that have been hitherto almost entirely neglected. We will return to the question of language vitality later on (p. 13–14).

Another characteristic of WEIRD societies is that they all have literary traditions stretching back several centuries, with new literature constantly being generated. WEIRD people are steeped in written language from an early age, and are exposed to it many times a day. Moreover, written communication, already central to these societies, has been given renewed impetus through the IT revolution, with text messaging and social media.

The languages chosen for this study, on the other hand, are spoken in predominantly oral societies, in which the drive to commit the languages to writing is a largely 20th century phenomenon. Even the oldest orthography represented in our series of experiments, Yoruba, has a literary tradition that dates back only to the middle of the 19th century (Crowther, 1852). The orthographies of all the other languages have been developed within the lifetimes of many of the experiment participants, and some as recently as in the last decade.

This sociocultural aspect needs to be taken into account when designing a classroom experiment. In a predominantly oral society where most people are not reading anything on a daily basis, let alone in their first language, participants may quickly tire when they do read, so sensitivity is required when choosing the corpus size for a reading task. On the other hand, those living in predominantly oral societies tend to have sharper memory skills than those living in WEIRD societies: tell a rural African a telephone number, and it is immediately committed to long-term memory without the mediation of pen and paper. Again, this capacity needs to be borne in mind when conducting comprehension tasks.

So much for the societies themselves, now let's add the researcher to the linguistic mix. Typically, cognitive psychologists undertake experiments on their own languages: Dutch researchers tend to investigate Dutch; Chinese researchers gravitate towards Mandarin. In Africa, on the other hand, the extant experiments have often been carried out by researchers for whom the focal language is not their own

language. This dynamic places the researcher one step removed from the experiment procedure and requires sensitive management.

When oral reading error analysis is undertaken with WEIRD participants, it usually brings the researcher into face-to-face contact with the pupil. In Africa, on the other hand, it may be preferable for a researcher who does not speak the focal language, especially in the case of an expatriate, to keep a low profile during a classroom experiment in order to avoid the observer's paradox (Labov, 1970, p. 32), i.e. the phenomenon whereby the very presence of the researcher has an inhibiting impact on performance. That is why we trained L1 speakers of the focal languages to administer each phase of the experiments – the preparation, the procedure, and the scoring.

2.2 Literacy context

In WEIRD societies, most people become literate in their first language through formal schooling. The ubiquitous presence of writing in the environment means that most children are eager to learn to read. In fact, it is practically impossible to function in such societies without these skills.

In many parts of Africa, on the other hand, motivation for L1 literacy is patchy at best. Generally, across the ten focal languages, such motivation can be identified among four social groups. Motivation is highest among older people who have never been to school or who left school early. Seeing most of their children and grandchildren now complete primary school, and knowing that the opportunity of becoming literate in French or English has passed them by, they settle for learning literacy skills in the L1. Some in this group successfully use L1 literacy classes as a stepping-stone to learning the official language. Others, especially traders, show an interest in becoming numerate to avoid being cheated in the market. Christians, hearing that a translation of the Bible has been published or is in progress, are often motivated to attend literacy classes, especially in contexts where the L1 is already used extensively in the churches. Finally, a growing number of well-educated L1 speakers – many of whom have grown up outside of the homeland and feel detached from their family roots – are beginning to take an interest and pride in their linguistic and cultural heritage.

One of the principle reasons why the cognitive psychology of reading has made such impressive advances in WEIRD societies since the 1970s is that educators wanted to better understand how children acquire written language, in order to develop pedagogical materials and curriculums that adequately meet their needs at each stage of their development. And the experiments in the field have indeed

provided insight that has since impacted educational practice. Consequently, the largest proportion of experiments target children in the early stages of formal education. Across Africa, sadly, local languages are rarely the language of education or taught in schools, so children are seldom the beneficiaries of L1 literacy. Instead, governments, Christian missions, and NGOs tend to teach L1 literacy skills to adults who never had the opportunity of going to school or who have left school early. This consideration is what led us to conduct our series of experiments with adult participants.

2.3 Social context

Many WEIRD school children benefit from the latest technology in their classrooms: interactive whiteboards, language laboratories, and computer rooms. This is in stark contrast to L1 literacy in rural Africa, which often takes place in mud brick or cement block classrooms, dimly lit by a window, a solar-powered lamp, or, where electricity is present, a single light-bulb. Where such facilities are absent, classes may take place under a mango tree. Even in urban settings, classroom resources tend to be extremely limited: the teacher usually has to rely solely on blackboard and chalk.

WEIRD reading research, too, often takes place in purpose-built laboratories, containing sophisticated eye-tracking equipment and state-of-the-art tachistoscopes. The series of experiments reported in this book, on the other hand, were run with the bare technological minimum: a simple recording device and a laptop computer.

Such social contexts are probably what Henrich et al. (2010a, p. 29) had in mind when they coined the term “inconvenient subject pools”, so it will be instructive to enumerate some of the logistical challenges that are specific to such an undertaking in a rural African context.

- Some of the experiments took place in remote locations. All had relatively poor internet connections; some had poor telephone networks; others had no easy access to photocopiers. Some of the locations had no power at all, and the nearest cell phone charging points were several kilometers away. In those locations that did have power, precautions had to be taken against the possibility of power surges, cuts, and lightning strikes. A second recording device and a system for regular data back-up are necessities in such conditions.
- Researchers had to conduct their experiments with flexible timing to take account of latecomers, who were often tardy with good reason since they were travelling from remote villages on unsurfaced roads in the rainy season and many were dependent on erratic public transport.

- Recordings were frequently perturbed by noise pollution: hip-hop music from nearby bars, heavy traffic, chickens squawking, ceiling fans, and nocturnal insects. In only one experiment (Yoruba) did the researcher have the luxury of a soundproofed recording studio.
- The attitudes of participants can sometimes catch the researcher unawares. An entire cohort in one location refused to participate unless they could have access to the texts beforehand in order to prepare, because they felt it would reflect badly on their ability, and for fear of what appeared to be exam conditions.
- Many Africans use different names in different domains of their lives (home, work, church, official documents...), so it was a continual challenge to ensure that exactly the same name appeared on the sociolinguistic questionnaire, the written text, and the recorded file.

Experimental research coming out of Africa needs to be read and understood with such logistical challenges in mind. But we must balance the picture too, and underline that there is also much that is highly “convenient” about an African subject pool. In all ten language groups, we had the privilege of working with participants who were hospitable, co-operative, flexible, spontaneous, patient, disciplined, respectful, and motivated. Indeed, for researchers who have spent any length of time in Africa, it can sometimes look as if the real “inconvenient subject pools” are located in the West, where some of these values – so helpful for lubricating experimental procedure – are less highly prioritized. For these reasons, we enthusiastically recommend African minority languages for any linguists or psychologists wanting to move beyond WEIRD experimental research.

2.4 Researchers’ objectives

When comparing reading research in WEIRD societies with the kind of research reported in this book, we can also identify differences that have to do with the researchers’ motivation and objectives.

WEIRD research in the cognitive psychology of reading is often motivated by the need to better understand pathological behavior patterns of dyslexic children. Teachers, too, may conduct error analysis with individual pupils in order help them progress. For the series of experiments reported in this book, on the other hand, we intentionally recruited the most experienced readers we could find, reasoning that if competent readers struggle, it is likely that the problem lies with the orthography itself, which is the nexus of this research. This is still a relatively unusual approach, though not unknown (e.g. Chang et al. 1992; Koblitz, 1985; Li, 1992).

All the researchers engaged in this project were motivated out of a desire to see the experiment results eventually impacting orthography decisions in the language communities concerned. Detailed documentation of the orthography reforms that emerged during and following the research project is beyond the scope of this book. Nevertheless, it will be helpful to highlight certain general aspects of tone orthography reform to help set the scene.

In WEIRD societies, if orthography reform happens at all, it is usually a move in the direction of greater simplicity. Decision makers judge that, since the spoken language has evolved and the written language no longer corresponds to it, reform is necessary to bring them back into closer alignment. As for the focal languages reported in this book, they all have a history of full tone marking. Any reform, therefore, as in WEIRD societies, is probably going to be a move in the direction of greater simplicity, but not in order to reduce the gap between the spoken and written forms. Rather, reform may be embraced if experimental data can show that full tone marking is not contributing, or is contributing negatively, to performance.

Recent experiences of orthography reform in WEIRD societies such as Portugal (Kanashiro et al. 2008), Germany (Eisenberg, 2007), the Netherlands (Nunn & Neijt, 2006), and France (AIROÉ, 2000) are illustrative of just how resistant speech communities can be to even the most inconsequential tweaking of spelling rules. Resistance may be just as strong among orthography stakeholders in Africa. Professional linguists within the language community are often the most passionate defenders of full tone marking because they are trained in phonemic transcription and expect an orthography to represent all the contrastive sounds. Untrained lay people may also feel an attachment to full tone marking if the orthography already has a long history, as in Yoruba, or where a regional tradition encourages it, as in Togo and Benin.²

2. The orthographies of eleven languages in Togo and Benin mark tone fully, a regional tradition that began in the 1980s. In general one encounters less resistance to diacritics in francophone than in anglophone African countries (Cahill, 2001).

3. The ten focal languages

3.1 Location and genealogical affiliation

The experiments took place between February and September 2015 in the following locations (Table 1 and Figure 1).³

Table 1. Focal languages and experiment locations

| Language | Location | Country |
|-------------|--------------------------|---------------|
| Elip | Yambassa, Balamba | Cameroon |
| Mmala | Yorro, Kedia | Cameroon |
| Yangben | Yangben, Patanga, Omende | Cameroon |
| Tem | Sokodé | Togo |
| Ife | Atakpamé | Togo |
| Mbelime | Cobly | Benin |
| Nateni | Tanguiéta | Benin |
| Idaasha | Dassa-Zoumé | Benin |
| Yoruba | Jos | Nigeria |
| Eastern Dan | Man, Santa | Côte d'Ivoire |

The focal languages were chosen purely on the basis of their accessibility to those researchers who volunteered to participate in the research project, not on any typological criteria. As it happens, they are all members of the great Niger-Congo phylum, but within that, they represent a range of linguistic families: Mande, Gur, Ede, and Bantu A62 (Figure 2).

The most recent available population statistics are cited in each language summary chapter, but these should be treated with due caution. Most African governments do not inquire about ethnicity in their national censuses. Even if they did, the responses would be difficult to interpret because of the phenomena, especially in urban centers, of mixed marriages, mixed neighborhoods, and households in which children are encouraged to speak the official language in order to prepare them for school. Furthermore, researchers often make unsubstantiated estimates that are then blithely propagated as facts in all succeeding publications. At the very least, all published population figures need to be adjusted to include the estimated

3. The names of African languages and their populations often vary morphologically between glossonyms (e.g. Nateni) and ethnonyms (e.g. Natemba). In this book, for the sake of clarity, we will systematically use glossonyms whether we are referring to the focal language itself or the participant(s) who speak(s) it.

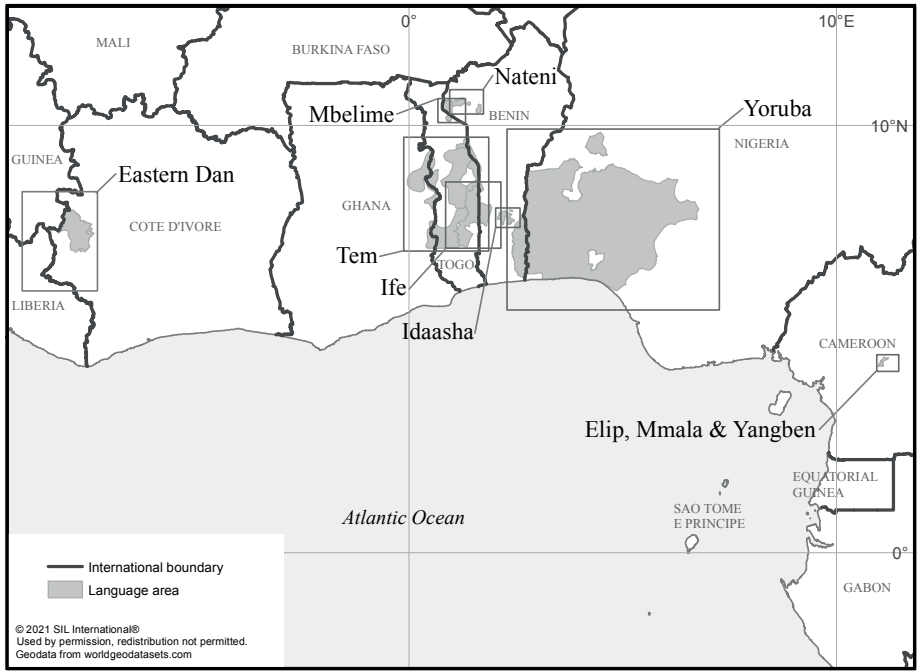


Figure 1. Geographical locations of the focal languages

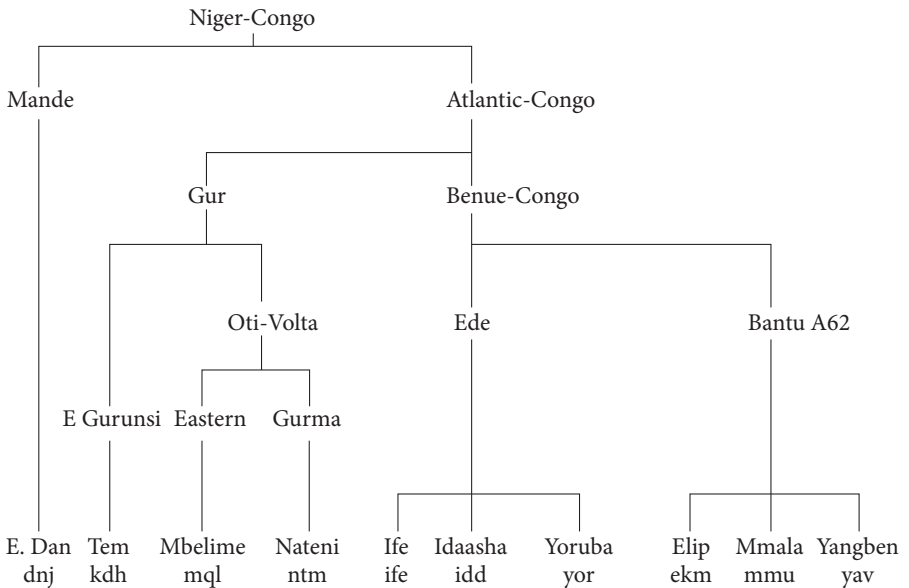


Figure 2. Genealogical affiliation of the focal languages

annual growths for each country, that is, 2.7% for Cameroon, 2.6% for Nigeria, 2.8% for Benin, 2.6% for Togo, 2.5% for Côte d'Ivoire.⁴

3.2 Language vitality

It will also be helpful to plot the ten focal languages on the *Expanded Graded Intergenerational Disruption Scale* (EGIDS; Lewis & Simons, 2010), an instrument with thirteen levels developed for assessing language vitality.⁵ According to Eberhard et al. (2020), six of the focal languages (Elip, Idaasha, Nateni, Mbelime, Ife, Eastern Dan) are classified at level 5, defined as “developing ... in vigorous use, with literature in a standardized form being used by some though this is not yet widespread or sustainable.” A seventh language, Tem, is elevated to level 3, defined as being a language of “wider communication ... used in work and mass media without official status to transcend language differences across a region.” We question this classification, since the use of Tem as a language of wider communication in the north of Togo is limited to basic commerce, and although it is one of four Togolese languages chosen by the government for promotion in non-formal education,⁶ it is by no means prominent in mass media. Yoruba, on the other hand, does fit comfortably into level 2, defined as “provincial ... used in education, work, mass media, and government within major administrative subdivisions of a nation.” That leaves Mmala and Yangben, which fare less well. They are both consigned to level 6b, which is defined as “threatened ... used for face-to-face communication but losing users.” All the focal languages, then, occupy the middle ground. None are classified at the top of the scale as International (0) or National (1), nor at the other extreme, as Shifting (7), Moribund (8a), Nearly extinct (8b), Dormant (9), or Extinct (10).

The summaries of the state of vernacular literature production in the following chapters might give the impression of a burgeoning indigenous literacy culture in West Africa. This is absolutely not the case. Publications in the focal languages – with the exception of Yoruba – are typically limited to minuscule print-runs of between 50 and 500 copies. We report them because they add color and depth to the ethno-literacy context, but little would be gained from listing them all in the bibliography. The only exception we make is the pedagogical materials – orthography guides, primers, and transition courses – that provide technical details about the orthographies themselves and demonstrate how tone should be taught.

4. Source: UNDESA (2019). Johannes Merz considers the percentage for Benin to be too conservative. The 2013 Beninese national census states an annual growth rate of 3.5% (INSAE, 2015, p. 4).

5. For a summary, see <https://www.ethnologue.com/about/language-status> (accessed 26 January 2021).

6. The other three languages are Ewe, Kabiye, and Moba.

A similar point can be made in passing about the use of some of the focal languages on radio and television. This may appear to be an encouraging sign of L1 literacy really taking root in other media – after all, presenters normally need an exceptional level of oral reading fluency – until one learns that in fact many of them have no L1 literacy skills at all. Rather, on live programs, they are expected to orally and simultaneously translate from written texts in the official language into the local language.

Returning to print media, the only book to buck the trend of small print-runs is the Bible. A complete translation exists in one of the focal languages (Yoruba) and the New Testament is available in four others, two having been published prior to our experiments (Eastern Dan and Ife) and two following them (Nateni and Tem). Such publications are often run-away bestsellers in overwhelmingly oral societies.

However, the Bible translators who are currently working in the other focal languages can by no means assume that their own products will eventually attract many sales: in general, literacy workers across West Africa struggle to ignite and maintain motivation. Learner numbers are typically small; abandonment rates are high. Literacy programs are frequently interrupted by the agricultural cycle, ceremonies, bereavement, civil unrest, and – twice in the case of Côte d’Ivoire – civil war. Even discounting any of these factors, it takes great commitment for a woman to complete a literacy course that does not put food in the mouths of her children (Cheffy, 2014). And even if she does, she is unlikely to become fluent and autonomous because opportunities to practice reading and writing outside of the classroom are so scarce.

3.3 Previous research

We undertook no primary phonological research on the tone systems of the focal languages in preparation for the experiments because our aim was to take a snapshot of existing literacy practice based on current knowledge. The research presented here therefore represents the view from the trenches. We intentionally put the well-tried approach of phonological analysis momentarily to one side, in order to come at the issue from a less exploited angle, making the classroom itself the locus of linguistic research. Inevitably, then, some languages fare better than others. Less has been published about the tone systems of Ife and Idaasha than the other languages, and much remains to be discovered about Nateni and Tem. The only work on the tone systems of Elip, Mmala, and Yangben is in a PhD dissertation focusing on vowel harmony (Boyd, 2015). Apart from Yoruba, Mbelime is the language with the tone system that has received the most attention (see p. 64), which is fortuitous because it has arguably the most complex tonal processes of all the focal languages.

3.4 Orthographies

The orthographies of the focal languages cannot be said to be representative of African languages in general precisely because they all mark tone fully, whereas many African languages do not. This should give us pause to consider what persuaded orthography developers in these particular language communities to opt for this strategy in the first place.

In some areas, a local tradition encourages full tone marking. This is the case in Togo and Benin, where decision makers often opt for it merely on the basis of having seen it used in a neighboring language. Elsewhere, it could be that either preliminary linguistic research or a layman's instinct persuaded decision makers, rightly or wrongly, that the functional load of tone was too heavy to do other than mark tone fully. This was certainly the case in Eastern Dan, which has an unusually high number of contrastive level tones, contour tones, and many monosyllabic words. Either way, we should not forget that the experiments reported here, by their nature, exclude languages on the very light end of the functional load of tone spectrum, because, to our knowledge, no such language marks tone fully.

The orthographies of some of the focal languages – Yoruba, Ife, Tem, Nateni, Idaasha – are relatively well-accepted; we remark no clamor for change in these speech communities. But in other contexts, we found ourselves participating in a social dynamic where the orthographies were still evolving – or at least being debated – even as we undertook the experiments. Elip, Mmala, and Yangben officially opted for full tone marking in the same year as we did our fieldwork. Discussions in the Mbelime community concerning which tone to leave unmarked spanned the whole period of our research and were concluded two years after the experiment (CNLM, 2017; Olson, 2020). In Eastern Dan, orthography stakeholders have recently adopted a radical and far-reaching reform, and our research in that location contributed to that outcome (Roberts et al. 2019; Vydrin et al. 2019).

4. Pedagogical materials

Orthographies are also foundational in the development of pedagogical materials. While tone studies and, more recently, tone orthography studies such as presented in this book are fairly easy to find, the same cannot be said of research addressing tone pedagogy. This is surprising given that hundreds of teaching materials for tone languages where tone is represented in the orthography are in use throughout Africa and other parts of the world. The following sections present a review of the literature regarding tone pedagogy in literacy primers (Section 4.1) and transition guides (Section 4.2). This will pave the way for the following chapters, where the

literacy primers and transition guides used in each of the focal languages will be described and evaluated in light of the recommendations of researchers and practitioners discussed here.

These evaluations will help to reveal why certain groups performed as they did in the experiments. We did not track by what means participants learned to read their language as an independent variable, so any interpretation will be purely qualitative. However, offering pointers on the merits or otherwise of these pedagogical materials may help to improve future editions not only in the focal languages, but also in other languages whose orthographies use full tone marking.

4.1 Literacy primers

A *literacy primer* is a publication that targets those who have never learned to read, either because they never went to school or because they dropped out after only a year or two. A primer teaches the orthography from scratch and is entirely written in the L1. Teachers of beginning readers know that for alphabetic languages, phonological awareness is key to successful reading and spelling acquisition (Adams, 1990, pp. 303–306; Winskel & Iemwanthong, 2010, p. 1029). However, teachers as well as researchers around the world have also observed that for aspiring readers of tone languages, the development of tone awareness seems to lag behind that of segments (Bearth, 1977, p. 1; Davis et al., 2016, p. 197; Hollenbach, 2007, p. 2). This seems to be the case whether the functional load of tone for a given language is heavy or light, limited to just one or two grammatical categories, or even whether it is marked or unmarked in the orthography (Davis et al., 2016, p. 215; Hollenbach, 2007, p. 2). Another major factor of the ease or difficulty of learning a tone orthography is whether or not a consistent word image results from the chosen strategy (Bird, 1999b, p. 107; Kutsch Lojenga, 2014, p. 63; Winskel & Iemwanthong, 2010, p. 1046). Snider (2018, p. 98) contends that learners would be better served if teaching material focused on tone patterns instead of the more usual individual tones. Finally, Kutsch Lojenga (2014, p. 71) has observed that the absence of a tone mark to indicate a particular tone is often the most difficult concept to teach, regardless of whether it is marking lexical or grammatical tone.

There are three main ways of handling the development of tone awareness when lexical tone is marked. The first is to begin by teaching vowels and consonants and then proceeding to tone markings in context (Kadyamusuma & Kadenge, 2013, p. 86), as is done with Thai (Winskel & Iemwanthong, 2010, pp. 1031–1032). The second is to start with tone awareness exercises including the introduction of tone markings, and continue to teach and reinforce tone awareness while teaching the vowels and consonants (Kutsch Lojenga, 1993, p. 17; Wiesemann, 1995, pp. 28–29).

This approach is used in many of the primers reviewed in this volume. A third option, often used when vowel length or differing adjacent vowels are also a feature of the language, is to include tone marking drills when vowels are taught, introducing all the possible tone patterns across a given vowel, e.g. <á, a, à, áá, aá, àa, àá> etc.⁷ This last approach has been used in government primers developed in Benin that used an adapted Freire (1970) method and in Burkina Faso that used another method favored in the 1990s. Both of them are syllable-based methods.

However, when teaching grammatical tone marking, particularly when tone is not fully marked, raising awareness of grammatical structures and their relationship to the marking is more important (Burmeister, 1980, p. 11; Kutsch Lojenga, 1993, p. 14; 2014, p. 67). Burmeister recommends drilling, in context, the necessary grammatical constructions. Barnwell (1979, pp. 68–69) suggests introducing unmarked forms first and then the contrasting form(s), initially in a clear and non-ambiguous context, then in an analysis or reduction-type drill, and finally in a frame or contrast drill. The story or connected material for the lesson should include all forms learned.

When the focus is on lexical tone marking, researchers and the designers of basic primers advocate introducing tone early and reinforcing tone awareness often (Kutsch Lojenga, 1993, p. 17; Lee, 1982, pp. 319–321; Wiesemann, 1995, p. 28; Willetts, 1983, p. 185). Grammatical tone, on the other hand, is introduced according to productivity constraints, i.e. frequency in texts (Gudschinsky, 1973, p. 84), and when grammatical words or affixes will be useful in a lesson's story (Barnwell, 1979, p. 66). Many designers draw attention to the listening as well as the reading aspect of tone drills with a special symbol, such as a talking drum or other musical instrument used by the people. However, research-practitioners differ as to which tones are easiest for learners to identify. Wiesemann (1995, p. 27) states that most often low tone is easiest to hear. Burmeister (1980, p. 10), on the hand, recommends starting with the highest pitch in languages with more than two tones in order to clearly identify the different pitch levels.

The method most used to raise tone awareness is that of using tonal minimal pairs, preferably picturable, e.g. nouns (Barnwell, 1979, pp. 66–67; Kutsch Lojenga, 1993, p. 17; Wiesemann, 1995, pp. 28–29). After each pair is introduced, a short contrast exercise of these words is used, where learners identify which pronunciation goes with which spelling, generally in a 2 × 3 or 3 × 3 table. Another successful approach is to use keywords representing patterns that are taught (Bearth, 1977,

7. In some languages with vowel length that use this exercise, the doubled vowel signals only length, with the tone carrying across the entire vowel, e.g. <áá> stands for [áá], not [áá] as it does in Tem and the three Bantu languages, or [á ~ áā] as it does in Nateni.

p. 1; Burmeister, 1980, p. 10; Roberts, 2011, p. 89); these may or may not be tonal minimal pairs. For both methods, exercises may be used wherein students either classify a word given by the teacher in a given keyword pattern, or generate words that belong in a particular tonal category. Several authors (e.g. Bird, 1999b, p. 103; Burmeister, 1980, p. 10) have observed that these methods seem to work best for languages where tone is fairly stable, although they have been used for languages where tonal processes frequently change the tone pattern of a given word once it is in context. Additionally, Snider (2018, p. 98) stresses that all tone patterns need to be taught, not just the most common, and thus significantly increasing the number of lessons where tone is the focus.

Another issue for tone pedagogy arises when tone is marked only on contrastive words. This practice is not generally recommended. Wiesemann (1995, p. 28) remarks that it “is not good for reading and hopeless for writing.” The reason it is hard on writers may be that homographs activate all possible meanings (Kadyamusuma & Kadenge, 2013, p. 88). While not a major problem for readers of a tone orthography, writers must subsequently decide which tone marks go with the intended meaning (Wiesemann, 1995, p. 28).

Nonetheless, a number of African languages have opted to mark tone only on contrastive lexical pairs. When this happens, Barnwell (1979, p. 66) advocates introducing tone marks only when words needing them appear in the primer for the first time. Teachers’ guides should include instructions to ensure that the teacher is clear on the concepts and the procedure for teaching. In the first of these special lessons, after teachers read the minimal pair, they point out that the only visual difference between the words is the tone mark. Next, an exercise is done to identify whether words are visually the same or different from the first one in the line. After teachers explain the system, they give examples of other words that follow the same tone pattern. For each word they ask students if the pitch matches the first or second word of the key minimal pair, and then how the word should therefore be marked. Once everyone can hear the difference, board exercises reinforce the link between sound and marking. Each tone pattern in the language should receive its own lesson.

4.2 Transition guides

Transition guides, also known as transition primers,⁸ are generally written for native speakers of the language who have become literate in another language (French or English in the case of this study), usually at school, to help them transfer their reading and writing ability to their L1. The following chapters will evaluate tone pedagogy in the transition guides of all the focal languages except one (Yoruba). While the issues of tone pedagogy for this type of teaching material overlap with those for basic literacy primers, certain important differences arise; hence, this section.

In general, transition guides introduce the alphabet and basic grammatical features of the target language that receive special attention in the orthography. The focus is on teaching elements of the orthography that do not appear in the language that learners can already read, or that have a different value. As one of the elements not present in either French or English, written tone is always explicitly taught, but its place in the transition guide and the way in which it is taught varies.

While some of the transition guides for the focal languages are designed to be used in class, others have been developed as self-teaching guides. The latter precludes the use of the nonsense syllable strategy promoted by Bearth and Kutsch Lojenga (see below). However, the other approaches suggested in Section 4.1 above are applicable. A self-teaching guide includes answers to all writing exercises, usually in the back of the book. It may also include translations of longer stories.

Unlike pre-literates, people who have learned to read a European language already have a conception of print and what it represents. However, European languages are intonational, not tonal, so a frequent challenge for French or English literates who want to read their own language is developing the tone awareness needed to read and write tone, not just letters (Bearth, 1977, p. 2; Hunter, 1994, pp. 10–11). Hunter (1994, pp. 10–11) emphasizes that learners need much practice if they are expected to read and write accurately. She advocates activities that require students to read words and sentences aloud, and to listen to what is being read. This assists students “to hear as well as see the feature in focus” (p. 11, bold in original).

Kutsch Lojenga (1989, p. 33) recommends placing lessons on tone at the very beginning of the transition guide. She also advocates using a different approach to teaching tone for literates and semi-literates than for pre-literates (Kutsch Lojenga, 2014, p. 71). Although she advocates starting with two keywords, she then recommends a different approach for those who can already read. This consists of using

8. Some organizations prefer the term “transfer guide” or “transfer primer”, in order to avoid the connotation that the skills of one language are being left behind. The use of the word “transition” in this chapter does not mean to imply loss of skills, but rather a shift in the knowledge of what orthographic conventions mean in another language known to the reader.

nonsense syllables (i.e. legitimate syllables that are not meaningful words in the language), or nonsense sentences (i.e. sentences composed of a single CV syllable with varying tones which may or may not be real words in the language). Such activities force learners to focus on the tone marks (Kutsch Lojenga, 1986, p. 60) so that they are then able to use them in decoding unfamiliar real words. In this approach, the transition guide is for class use, with the teacher introducing a pair of tones and practicing with flashcards before having students read a nonsense sentence. These syllables only contain letters that are already familiar to the learner, not those that will be introduced in subsequent lessons (1989, p. 34). Additional tones, if present, are added (usually one new tone at a time) once the first two are mastered. Following the nonsense text, lists of several tonal minimal pairs (or triplets or quadruplets) using the tones in focus are given. Finally, sentences for each of the tonal minimal pairs just presented are used, preferably phrases that are identical except for those pairs (1993, p. 33). Although Kutsch Lojenga recognizes the importance of context in reading tone languages, she specifically prefers phrases to full texts when working with L2 literates and semi-literates in order to reduce the amount of context available to readers, thus compelling them to focus on the tone marks (1989, p. 34).

Bearth (1977, pp 1–2) describes two methods he used for French literates in Côte d'Ivoire when teaching Toura, a Mande language closely related to Eastern Dan in which tone has a very heavy functional load, both lexically and grammatically. He began by using a method in which each tone pattern is associated with a specific keyword, and had learners arrange slips of paper with various words (with French translations provided) in columns under the keyword, like a game. The class began with level tones and moved on to other tone patterns. However, while it helped the learners identify patterns, he noted that this method is not helpful once the word is in context, nor does it force learners to pay attention to tone marks. As a result, he also began to use the nonsense syllable and sentence method in order to overcome these weaknesses, with good results.

Finally, the issue of grammatical tone may be handled differently in transition guides than in primers, particularly with highly competent L2 readers. While in primers contrastive exercises are often used to introduce a particular grammatical function of tone with little or no linguistic explanation, in a transition guide, a lesson or even a chapter is often devoted to systems of the language that use tone, such as verbal inflection, pronouns, or other particles (Kutsch Lojenga, 1989, pp. 34–35). In these cases, explanations with examples, and occasionally exercises, are the dominant method of instruction. However, when the audience of a transition guide is semi-literate, then the focus features may be presented as in a traditional primer (Hunter, 1994, p. 9).

5. Definitions

The research question stated in Section 1 refers to *oral reading fluency*, so a definition is in order. Following Pikulski & Chard (2005, p. 510), we consider that “Reading fluency refers to efficient, effective word recognition skills that permit a reader to construct the meaning of text. Fluency is manifested in accurate, rapid, expressive oral reading...” It is this definition that guides us to measure oral reading fluency in terms of speed and accuracy. Most alternative definitions of fluency include reference to these three components (cf. Kuhn et al. 2010; Rasinski, 2006), and acknowledge that fluency is a reliable predictor of comprehension (Hudson et al., 2005, p. 702).

We detect a need in tone orthography studies for more precise terminology with respect to diacritic density. The Africanist literature tends to use two terms interchangeably: *full tone marking* (Bird, 1999b, pp. 94, 96; Kutsch Lojenga, 2008, p. 7; Mfonyam, 1990, p. 24) and *exhaustive tone marking* (Bird, 1999a, p. 1; Koffi, 2014, p. 63; Kutsch Lojenga, 2014, p. 71; Roberts, 2008, 2013, p. 95; Roberts et al., 2016, p. 114). We will separate these to draw a distinction that has hitherto been overlooked, using the term *full tone marking* to describe the African tradition of marking one fewer tones than the number of phonemic level tones in the language, which is the case in all ten focal languages,⁹ and reserving the term *exhaustive tone marking* for orthographies that mark each and every tone, a tradition that is virtually unknown in Africa.¹⁰

This introductory chapter has already used the term *L1* to refer to a person’s first language. However, in the rest of the book it will more often be used to refer to the focal language of the experiment under discussion, in spite of the fact that several of the samples included a small minority of participants for whom the focal language was not their L1. Similarly, the term *L2* is defined as being the official language of the country in which the experiment took place (English in Nigeria,

9. Beyond Africa, orthographies that mark tone fully, by this definition, include Vietnamese (Nguyễn, 1996) and Thai (Winkel et al., 2017, pp. 1283–1284; see this volume, pp. 239–240 for further discussion).

10. Orthographies that mark tone exhaustively, by this definition, include Romanizations of Asian languages such as Pinyin (Wang et al., 2015, p. 5; see this volume, p. 239 for further discussion), Hmong (Heimbach, 1969), and Naxi (Hé & Jiāng, 1985), as well as those that employ superscript numbers, such as San Juan Lealao Chinantec (Rupp & Rupp, 1996, p. 5), Iau (Bateman, 1991), and Nambiquara (Kroeker, 1996). However, a reviewer has noted that although Pinyin does indeed have four lexical tones and four tone diacritics, it leaves syllables with no inherent tone unmarked, because their tones are predictable from adjacent syllables.

French elsewhere), even though, for a minority, the official language was actually their L3 or even their L4.

We define an *orthographic word* as a character or sequence of characters flanked by space and/or punctuation (Van Dyken & Kutsch Lojenga, 1993, p. 3), and employ the term *diacritic* to mean any secondary graphic symbol that is associated with at least one letter, usually in order to modify its pronunciation. *Tone diacritics*, a sub-set of overall diacritics, consist of accents in nine of the focal languages and punctuation¹¹ in Eastern Dan.

Following Bird (1999a, p. 4, footnote 5), we use the term *orthographic Tone Bearing Unit* (orthographic TBU) to mean “any letter which can potentially be marked with a tone diacritic”. This includes all vowels and, in some of the focal languages, nasal consonants. In a language with contrastive vowel length, where a CVV graphic sequence can carry a tone diacritic on either or both vowels, such a sequence is counted as two orthographic TBUs, irrespective of whether it is the syllable or the mora that is the phonological TBU.¹²

Following Kutsch Lojenga (2014), we make a typological distinction between languages with *mobile tone systems* – those in which certain morphotonological processes occur once words are placed in context – and those with *stable tone systems* – those in which no such processes take place. In fact, this is not a binary distinction, because mobile tone systems may be more or less so. The only two languages with almost completely stable tone systems in this study are Nateni and Eastern Dan.

We define *orthography stakeholders* as any person who has an interest in and may be affected by the development of the written form of the language, whether or not they are from within the language community and whether or not they have decision-making powers.

11. In fact the inventory of Eastern Dan tone diacritics contains a mixture of three punctuation symbols and one mathematical symbol, but for the sake of brevity, we will refer to them all as punctuation symbols. See p. 91 for more details.

12. Except in the unusual case of a language like Kaansa (Burkina Faso) where only the first vowel of a CVV sequence carries the diacritic, even when the syllable-level tone pattern is a contour.

6. Outline of the book

The rest of the book is organized as follows. Part I introduces the linguistic, orthographic, and ethno-literacy backgrounds of each of the focal languages (Chapters 2–9), treating the three Bantu languages in a single chapter since they are so similar. Part II then reports the experiment results. After a chapter presenting the experiment design (Chapter 10), it deals in turn with oral reading speed (Chapter 11), general oral reading errors (Chapter 12) tonal oral reading errors (Chapter 13), oral reading comprehension (Chapter 14), and tone writing accuracy (Chapter 15). The Epilogue summarizes the implications of the experimental outcomes for each of the focal languages in turn and addresses various avenues for future research (Chapter 16).

7. Transcription conventions

It only remains to summarize the transcription conventions used. Phonemic data appears between /forward slashes/, phonetic data between [square brackets], and orthographic data between <chevrons>. In phonetic and phonemic transcriptions: the palatal approximant [j] is transcribed [ɣ] following the Africanist tradition, and nasal vowels are marked with a subscript tilde [ɔ̃]. Tone is marked with superscript diacritics: extra-high (xH) with a double acute accent [ó̊], high (H) with an acute accent [ó], mid (M) with a macron [ō], low (L) with a grave accent [ò], extra-low (xL) with a double grave accent [ö]; and contour tones on single orthographic or phonological TBUs with combinations of these (HL [ó̊], LH [ō], HM [ó], MH [ó], ML [ō], LM [ö]); non-automatic downstep – the lowering of tonal register, usually following a floating (unpronounced) L tone – is marked with a superscript downward pointing arrow [↓ó]; upstep is marked with a superscript upward pointing arrow [↑ó]. In tables showing phonographic correspondences, graphemes are only given when they differ from the IPA representation of the corresponding phoneme.

PART 1

Tone orthography in ten Niger-Congo languages

Tem (*David Roberts, JeDene Reeder, Andy Weathers*)

1. Linguistic and orthographic background

1.1 Affiliation and location

Tem¹ is a language belonging to the Eastern Gurunsi branch of Gur languages. It is spoken in Central Togo, in and around the town of Sokodé in the prefectures of Tchoudjo and Assoli. Sizeable populations reside elsewhere in Togo, especially in the prefectures of Bassar, Tchamba and Sotouboua, as well as in neighboring Ghana and Benin, and further afield in Niger, Nigeria, and Europe (notably Germany).

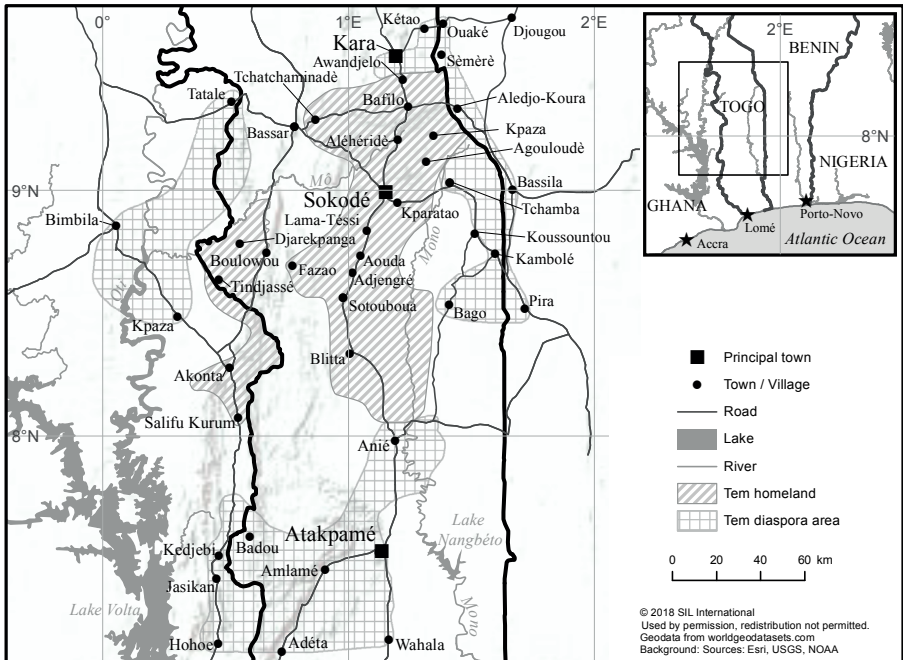


Figure 1. The Tem language area

1. ISO 639-3: kdh. Glossonym: [tèm] <Tem>. Ethnonym: sg. [tèmbú] <tembú>; pl. [tèmbiyà] <tembiya>. The pronunciations and spellings [tèm nni] <tem nni> (sg.) and [tèmbà] <temba> (pl.) are pejorative alternatives that draw attention to pre-Muslim Tem culture.

By far the majority of L1 Tem speakers are Muslim. Eberhard et al. (2020) citing Gblem-Poidi & Kantchoa (2012) estimate the Tem population to be 234,000 in Togo and 390,200 worldwide.²

Tem has three main dialects: Tchaodjo is spoken in and around Sokodé, Bafilo in and around the town of that name,³ and Fazao to the south and west of Sokodé (Sama, 2001, p. 9). However, residents of the Didauré neighborhood of Sokodé speak a fourth dialect, Kotokoli. Since they are descended from the foreign traders who originally brought Islam to the area, and who gradually adopted the Tem language, outsiders generally refer to all Tem people and their language as Kotokoli, as do many Tem people themselves, especially when communicating with outsiders. The Kotokoli dialect is generally the one that is spoken in markets beyond the Tem homeland.

As elsewhere in Togo, mixed marriages are increasingly common, especially in urban settings. But among the Tem this phenomenon tends to be unidirectional: it is not uncommon for a Tem man to choose a wife from a neighboring ethnic group, but much less common for Tem girls to accept marriage proposals from other ethnic groups, especially if the latter are non-Muslim.⁴

The Tem are active in commerce and transport, which has led to their language functioning to a limited extent as a trade language in parts of the north of Togo. The neighboring groups (particularly Akaselem, Foodo, Bago and Kusuntu) are often bilingual in Tem, but knowledge of Tem in other northern ethnic groups (Kabiye, Lama, Nawdm, etc.) tends to be limited to basic greetings and market vocabulary, unless the speaker has lived in a Tem-speaking area. Most Tem speakers who are engaged in commerce or transport also speak Ewe. Bilingualism in French, the official language of Togo, is similar to that found in other ethnic groups, that is, the degree of fluency correlates with years of formal schooling. Field observations lead us to believe that Tem children in Sokodé are more bilingual in French than are their Ewe counterparts in the south of Togo.

-
2. It is likely that these population estimates are too modest for the reasons stated on p. 11.
 3. Alternative names for this dialect are Assoli and [bòù] <bóú>, meaning mountain-dwellers. The latter term is the most inclusive of the three, as it encompasses the entire mountainous area around Bafilo, as well as the area to the north and east of the town. Calling the dialect “Bafilo” is common but arguably less precise because many from the Mola clan in that town actually speak the Tchaoudjo dialect.
 4. As Zakari Tchagbalé (p. c.) points out, this is due to the influence of Islam, which authorizes a Muslim man to marry a non-Muslim woman only as long as she is one of the “people of the Book”, i.e. a Christian or a Jew. Inter-ethnic marriages were not prohibited in pre-Muslim Tem culture.

1.2 Orthography development

The earliest Tem publication in circulation is a booklet about farming cotton which assumes knowledge of an apparently pre-existing orthography (SOTOCO, 1974). Tone is not marked in this publication – the only diacritic marks ATR distinction, with <i, î> representing /i, ɪ/, respectively, since the manual typewriters of that time were adapted for Ewe and did not have the now commonly used iota <ɪ>.

Apart from such patchy and largely undocumented efforts, orthography development began in earnest with the arrival of an SIL team in 1978. Working with literacy stakeholders in the Tem community, they developed an orthography that marks tone fully. Tchaodjo was chosen as the reference dialect because all Tem speakers understand it. This orthography has achieved broad acceptance throughout the Tem community and is still in use. It is one of the orthographies featured in Hartell (1993, p. 291).

Full tone marking is almost always adhered to in literature published in Sokodé itself. However, those working further afield do not always mark tone. Organizations such as CREATEM (*Centre de la Recherche Académique Tem*), who operate primarily in anglophone Ghana, tend to ignore tone, doubtless because of the influence of the English orthography, which contains no diacritics (Cahill, 2001). But the practice is not limited to Anglophones: about half the contributors on the largest Tem Facebook group, *Parlons Tem*, mark no tone in their postings.⁵

Abandoning tone marks may be due to several factors. Firstly, the Togolese formal education system never teaches tone. French, the language of instruction, is a non-tonal language; Kabiye, a closely related language which is taught as an optional exam subject, is tonal but the orthography marks no tone; as for Tem itself, it is not taught at all in schools. Secondly, many Tem literates complain that they do not know how to write tone correctly since tone patterns change between isolation and context forms (See p. 34). Thirdly, the few Tem people who have access to computers do not usually have keyboards adapted for typing the Tem accents and special characters. Installing a MSKLC (*Microsoft Keyboard Layout Creator*)⁶ can actually be done in five minutes, but most Tem IT specialists have not yet been trained to do this.

5. <https://www.facebook.com/groups/105739646183052/> (There were 18,200 members when accessed on 26 January 2021). Even Zakari Tchagbalé, the prominent Tem linguist, endorsed zero tone marking in a Facebook posting on 13 June 2016. <https://www.facebook.com/groups/105739646183052/permalink/1033255253431482/> (accessed 26 January 2021).

6. The MSKLC keyboard designed for Tem can be downloaded from <http://www.tembiya.net/fr/claviers-et-polices> (accessed 26 January 2021).

In 2016, following the experiment reported in this book, Tem delegates participated in a three-week SIL workshop in Kara, Togo, with the aim of assessing the level of written ambiguity if tone is not marked. They report that the functional load of tone in Tem is weighted towards the grammar, and plays a particularly important role in the verb system (Weathers, 2020, pp. 12–15).

Three other orthography initiatives deserve mention. Firstly, a Braille orthography predates the standard, with the first version appearing in 1970 and the second in 1973 (Robert De Craene, p. c.), followed by the publication of a Braille primer (De Craene & Tchagbra, 1997a). Secondly, an Arabic script orthography, developed in 2004, has been used for some translations of Qur'anic passages, and for a book on Malik religious practices (Kordow, 2006, 2013). Script choice as a means of expressing religious identity is illustrative of a wider movement in West Africa (Warren-Rothlin, 2014). Thirdly, the Tem linguist, Zakari Tchagbalé, participated in a research group sponsored by CASAS (*Centre for Advanced Studies of African Society*)⁷ whose aim was to develop a harmonized orthography for Gur languages (Nikiéma et al., 2005). In theory, this orthography aims to cater equally well for Tem as for the other 96 languages in the Gur family. In practice, it remains largely an academic exercise and hardly any Tem speakers are aware of its existence. None of these alternative orthographies is the focus of our experiment, though we recommend them as topics for future writing systems research.

As for orthography reform, it has been known for differing groups to act independently of each other, but it is generally agreed that, for effective change, decisions require the participation of all stakeholders. These include the members of the *Comité de Langue Tem* (CLTem), the various agencies involved in literacy, language development and translation, representatives from the Tem diaspora, and religious leaders.

Figure 2 shows a text written in the standard Tem orthography to show the visual effect of full tone marking.⁸

7. <http://www.casas.co.za> (accessed 26 January 2021).

8. The text sample is borrowed from Bird (1999, p. 112), and was translated into the ten focal languages. A free English translation of the sample, the content and meaning of which is the same for all the text samples in the subsequent language summaries (Chapters 3–9), is: “Once upon a time, a squirrel and a dog were friends and always went about together. One day, they decided to get a sack and take themselves off to a grove to steal oranges. They left the house, and on arrival at the grove the squirrel said to the dog: ‘Since I am small and supple, I will climb the tree. You stay down below to collect the fruit and put it in the sack’”. We reproduce the Tem text as it was written and checked by experienced literacy staff and as it was presented to participants in the experiment. However, Zakari Tchagbalé (p. c.) has identified six words that he considers to be incorrectly marked for tone.

Kpáará na fɔ́ bɔ́ɔɔ ná, nge baabá begéé dɔ́ndunáa, bika bovoo d́amá béngilím. Wíre bijɔ́ɔ né, nge bɔ́ɔdɔ́ d́amá sisi bɔ́ngbɔ́wɔ́ furúú beq́éé fɔ́ nekére-daá bakánmílu léémúu. Baanmáti bulé né, nge baalí d́aána bɔ́kpɔ́ɔ nínbááwo háli batála léémúu fɔ́-daá. Baadála né, nge kpáará wɔ́ɔdɔ́ fɔ́ sisi: « Mɔ́dɔ́ndi! Nyááná sisi mɔ́s mɔ́dɔ́dɔ́ɔ, bika dɔ́dɔ́ mévéyí yíni. Bulé né mɔ́s mángbáa ku tuwu, mɔ́ngɔ́gɔ́rú bika nyɔ́s njɔ́ ade nyóndɔ́ɔzi nyándúu furúu; yáá wé? »

Figure 2. Tem written with full tone marking (Standard orthography)

1.3 Previous research

The two earliest references to Tem in the linguistic literature are fifty years apart (Koelle, 1854; Muller, 1905) and are followed by a silence of equivalent length. Tem makes its next appearance in a discussion of the Gur languages that are listed in the *Polyglotta Africana* (Köhler, 1964). An early grammar (Lelièvre, 1950a) has apparently been lost (Derman, 1983, p. 49).

The pace picks up from the 1970s onwards. We find a folktale corpus with phonetic transcriptions and glosses (Abby-Alphah Mama Ouro-Djobo, 1978), and research devoted to morphosyntax (Atta, 2005; Bawa-Bocco, 1981; De Craene, 1986; Sama, 2001), loanword lexicology (Tchadouwa, 1996), phonology (Arouna, 1998; Copans, 1971), and semantics (Wouro-Banna, 1994). Bybee et al. (1994), in their worldwide overview of TAM systems, repeatedly refer to Tem (pp. 64–65, 84, 252, 329, 332–333, 350) using examples from Der-Houssikian’s (1980b) language learning book.⁹ Tem is also included in several comparative studies of Eastern Gurunsi languages (Delord, 1988; Kleinewillinghöfer, 1997; Manessy, 1969, 1995; Sama, 2004; Westerman, 1933).

As for the domain of lexicology, Derman (1983) produced a trilingual Tem-French-German dictionary containing 9000 entries.¹⁰ In it, the author (p. 49) refers to Lelièvre’s (1950b) dictionary which, like his grammar, has apparently been lost. In addition, De Craene (1989) compiled a small lexicon of market terminology and, more recently, the language committee has published a bilingual Tem-French dictionary containing 5425 entries (CLTem & SIL-Togo, 2012).¹¹

Zakari Tchagbalé has made a distinctive contribution to the field of Tem linguistics. Beginning with a dissertation on grammatical categories (1972), he went on to produce a full descriptive grammar (1976). He has continued to make a wide range of contributions, on subjects such as the verb system (1998), vowel

9. Cited by Dryer & Haspelmath (2013).

10. Derman (1983) has recently been republished posthumously as Derman (2017).

11. A digital edition of the dictionary with 5258 entries is available at tem.webonary.org (accessed 26 January 2021).

harmony (Kabore & Tchagbalé, 1998, pp. 472–473), the infinitive (2000), nasal relators (2003), and topic and focus (2006).

In tonology, Tchagbalé investigates the tone system in a phonetic analysis (1976, pp. 95–155), and a pitch accent analysis (2001). Akinlabi & Liberman (2007) discuss the theoretical implications of Tchagbalé's research in a paper on the prosodic organization of tone.

1.4 Typology

Tem is an agglutinative SVO language with nine noun classes, specified by suffixes, that can be grouped into five genders (Tchagbalé, 2006, pp. 122–123).¹² Tem also has total ATR vowel harmony and partial height and fronting harmony (Kabore & Tchagbalé, 1998, pp. 472–473; Tchagbalé, 1976, pp. 69–71). Following a widespread tradition in Africa, vowel harmony is written transparently in the orthography.

1.5 Consonants

Table 1 presents the consonantal grapheme-phoneme correspondences in the standard orthography.

Table 1. Tem consonantal grapheme-phoneme correspondences (based on Tchagbalé, 1976, p. 56)

| | Labial | Dental | Retroflex | Palatal | Velar | Labio-velar | Glottal |
|-------------|-----------------|-------------|-------------|-------------|-------------|----------------|---------|
| Stop | b (p) <p, b> | d <t, d> | ɖ <ɖ, r> | ɗ <c, j> | g <k, g> | ɡb <kp, gb> | |
| Fricative | v <f, v> | z <s, z> | | | | | (h) |
| Nasal | m | n | | ɲ <ny> | ŋ | ŋm <ŋm> | |
| Approximant | | l | | y | | w | |
| Flap | | /r/ <r> | | | | | |

In Table 1, the eye is immediately drawn to the orthographic over-representation of obstruent phonemes. According to Tchagbalé (1976: 44), the voiceless series [t, tʃ, k, kɸ, f, s] and the voiced series [d, ɗ, g, ɡb, v, z] are in complementary distribution, the former appearing in initial position and the latter intervocally and following nasals. However, it seems likely that the conditioning is more complex than this,

12. Zakari Tchagbalé (p. c.) now considers that Tem has four genders.

which is why we have retained voiced and voiceless obstruents in the phonemic transcriptions that follow, as indeed Tchagbalé does.

Two peripheral phonemes are included in the chart in parentheses: /p/ <p, b> appears only in borrowed words and ideophones, and /h/ <h> only in borrowed words and interjections (Derman, 1983, pp. 19–20; Tchagbalé, 1976, pp. 37–38).

The palatal nasal /ɲ/ is represented by the digraph <ny> (1a), and the sequence /ny/ by a succession of two graphemes <n̄y> (1b), the diaeresis being added as an anticoagulant, following the French convention (CLTem & SIL-Togo, 2012, p. 43).¹³

- (1) a. /ɲédɛ̃/ <nyédɛ̃> *greater cane rat*¹⁴
 b. /bányáá/ <bán̄yáá> *they call*

The phonemic status of /r/ is not clearly explained in the literature.¹⁵ The grapheme <r> is used in word initial position in a few borrowed words (2a) as well as in several integrated words, both word-initially (2b) and word-medially (2c; CLTem & SIL-Togo, 2012, pp. 42, 204).

- (2) a. /réézà/ <réeza> *razor*
 b. /ràwó/ <rawú> *neighbor*
 c. /fɔ̀r̀tò/ <fɔ̀r̀ɔ̀tɔ̀> *woven sack*

1.6 Vowels

Table 2 presents the vocalic grapheme-phoneme correspondences in the standard orthography.¹⁶

Table 2. Tem vocalic grapheme-phoneme correspondences (based on Tchagbalé, 1976, p. 24)

| | Front | | Back | |
|-------|-------|-------|------|------|
| | +ATR | -ATR | +ATR | -ATR |
| Close | i | ɪ <ɪ> | u | ʊ |
| Mid | e | ɛ | o | ɔ |
| Open | a | | | |

13. The trilingual dictionary departs from the standard orthography at this point by writing the sequence /ny/ as <ɲy> (Derman, 1983, p. 13).

14. *Thryonomys swinderianus*. Known locally in French as *agouti* or, in English, *grasscutter*.

15. The underlying forms of some of the examples containing <r> in this chapter are therefore debatable and would merit further research.

16. Some publications use <ɔ> to represent the phoneme /ɔ/, which is an influence from Ewe, the vehicular language for the south of Togo, but <ɔ> was selected by the language committee (CLTem) in 2006.

In all cases except the –ATR close front vowel /ɪ/, vowel grapheme symbols are the IPA equivalents. Vowel length is contrastive: long vowels are written by doubling, and extra-long vowels by tripling the letter.

In the pedagogical materials, consonants are introduced as “adults” and vowels as “children”. In turn, –ATR vowels are called “girls” and +ATR vowels “boys”. Pairs of vowels that only contrast by their ATR values are referred to as “twins” (e.g. De Craene & Tchagbra, 1996a, pp. 5–7).

1.7 Tone

1.7.1 Generalities

Tem has two discrete level tones, H and L, plus automatic and non-automatic downstep. Numerous tonal processes occur once words are placed in context. It seems likely that the phonological TBU is the mora, but this point awaits further investigation. All vowels bear tone, as do preconsonantal and word final nasals. The Tem orthography marks H tone with an acute accent and L tone with absence of an accent.

1.7.2 H tone spread

Whenever the tone pattern HL occurs, the H tone spreads rightwards onto the following L tone. In other words, a L tone is pronounced at the same pitch as the H tone that immediately precedes it (3; De Craene & Tchagbra, 1996b, p. 22).

(3)

/bà à bá # wà à nà # á gó ró/
[bà à bá # wá à nà # á gó ró]
<Baabá waana Ágóró.> *Father saw Agoro.*

Here are some other examples (4; based on De Craene & Tchagbra, 1996b, pp. 23–24).

- (4) a. /mááná ìgòmà/ → [mááná ìgòmà] <Mááná ìgɔma.>
I saw the foreigners
b. /bààlá kòd̥z̥òòrìyà/ → [bààlá kòd̥z̥òòrìyà] <Baalá kɔɔɔrɪya.>
They formed a cooperative.

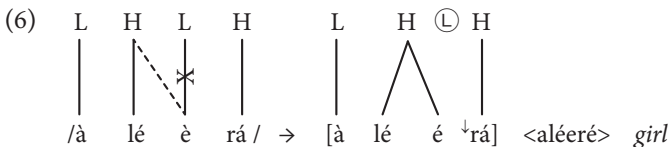
H tone spreading is a post-lexical process in Tem, that is, one that occurs wherever the phonological condition is met, within words and across word boundaries. The Tem orthography represents the output of the lexical phonology, not the surface form.

The only exception to the H tone spreading rule is when the L tone in question occurs at the end of a phonological phrase – the pedagogical materials state “before a punctuation mark” (5; based on De Craene & Tchagbra, 1996b, p. 25).

- (5) a. /m'éédǫ́ mótò gè/ → [m'éédǫ́ mótó gè] <M'éédǫ́ mótó gɛ.>
*It is maize dumpling that I ate.*¹⁷
 b. /m'éédǫ́ mótò/ → [m'éédǫ́ mótò] <M'éédǫ́ mótó.>
I ate maize dumpling.

1.7.3 Downstep

Tem also has automatic downstep, a common process in African languages whereby, within a phonological phrase, any H tone following a L tone is pronounced lower than the preceding H, and any L tone following a H tone is pronounced lower than the preceding L. In other words, the presence of a L tone causes a lowering of the entire tonal register (De Craene & Tchagbra, 1996b, p. 27). Downstep is triggered by underlying tones, not surface tones. This process also occurs across word boundaries (De Craene & Tchagbra, 1996b, p. 28). In example 6, the H tone on /lé/ spreads rightwards onto the following syllable, and the L tone on /e/ is set afloat, causing the H tone on /rá/ to be pronounced on a lower register than the H tone on /lé/ (De Craene & Tchagbra, 1998, p. 4; and see Tchagbalé 1976, pp. 134–142).¹⁸

- (6) 

 /à lé è rá / → [à lé é ↓rá] <alééré> girl

Here are some other examples (7–8; De Craene & Tchagbra, 1998, pp. 6, 11, 13, 17).

17. Zakari Tchagbalé (p. c.) suggests the glosses “it’s when I ate maize dumpling that…” or “I just ate maize dumpling” (our translation from his French).

18. This is an areal phenomenon that has been reported in various neighboring languages including Foodo (Plunkett, 2009, pp. 132–133), Kabiye (Roberts, 2016, pp. 137–138) and Kɔɔni (Cahill, 2004, pp. 5–6) among others.

- (7) a. /tээрэ/ → [téé⁺ré] <tээрэ> *morning*
 b. /кпííróó/ → [кпííró⁺ó] <кпííróó> *boat*
 c. /wánḏzáádì/ → [wán⁺ḏzáádì] <wánjáádì> *(s)he looks for*
 d. /máagábìsì/ → [máá⁺gábìsì] <máagábìst> *I have come back*
- (8) /Máálá tìmé nààrè/
 [máálá tí⁺mé ná⁺árè]
 <Máálá tumé naàre.>
I did some work.

1.7.4 Lexical tone

A perusal of the literature reveals several tonal minimal pairs among nouns, for example (e.g. 9).¹⁹

- (9) a. /ḑòm/ <ḑóm> *snake* (Atta, 2005, p. 33)
 /ḑóm/ <ḑóm> *sleep*
 b. /fḥò/ <fḥó> *dog* (Weathers, 2020, p. 12)
 /fḥó/ <fḥó> *field*
 c. /tèm/ <Tem> *Tem language* (Derman, 1983, p. 14)
 /tém/ <tem> *type of tree*

And several tonal minimal pairs (e.g. 10a, 10b) and one triplet (10c) among verbs.

- (10) a. /fà/ <fáa> *to give* (Sama, 2001, p. 22)
 /fá/ <faá> *to catch fire*
 b. /lù/ <lúu> *to draw (water)* (Tchagbalé, 1976, p. 85)
 /lú/ <luú> *to bend down*
 c. /tjáádì/ <caádi> *to sieve* (Derman, 1983, p. 14)
 /tjáádí/ <caadí> *to be worn out*
 /tjáádì/ <cáádi> *to seek*

1.7.5 Grammatical tone

Some TAM categories are distinguished by tone alone, for example the imperfective/future and the iamative²⁰ (11; Weathers, 2020, pp. 12–13);

- (11) a. /mánbìzì/ → [mánbíizì] <mánbuzì>
 1. I can 2. I will be able to
 /mánbízi/ → [mánbíizi] <mánbíuzi>
 I have already been able to

19. This count and those that follow exclude tonal minimal pairs cited in the literature that are contested by our informant. We have modified the spelling of others, including the tones, to conform to the standard orthography.

20. Following Olsson (2013), we employ the term “iamative” to label the Tem grammatical marker which translates into English as “already”.

- b. /ɲáɲmààzí/ → [ɲáɲmààzí] <nyánmaazí>
 1. *you think* 2. *you will think*
 /ɲáɲmáázì/ → [ɲáɲmáázì] <nyánmáazì>
you have already thought

the infinitive and the imperative (12; Atta, 2005, p. 34);

- (12) a. /ɖèé/ <ɖéé> *to go*
 /ɖèè/ <ɖéè !> *go!*
 b. /kɔ̀pási/ <kpasí> *to sweep*
 /kɔ̀pási/ <kpasì !> *sweep!*

the consecutive and the imperative (13; Weathers, 2020, p. 13);

- (13) a. /íléè/ <íléé> *(and) he/she withdraws*
 /íléè/ <íléé> *may he/she withdraw!*
 b. /bàsúù/ <basóú> *(and) they enter*
 /bàsúù/ <básóú> *may they enter!*

and the 2nd person plural and 3rd person singular imperatives (14; Weathers, 2020, pp. 13–14).

- (14) a. /íbo/ <ibó> *go (pl.)!*
 /íbo/ <íbo> *may he/she go!*
 b. /íbìsì/ <ìbísì> *return (pl.)!*
 /íbìsì/ <ìbísì> *may he/she return!*

Finally, it is not uncommon for the interplay of lexical and grammatical tone to generate contrasts on disyllabic words that exploit all four possible tone patterns (15; Weathers, 2020, pp. 14–15).

- (15) a. /bíkṗá/ <bíkṗá> *may it rise!*
 /bíkṗà/ <bíkṗa> *(and) it rises*
 /bíkṗá/ <bíkṗa> *1. may it stick! 2. may it pinch!*
 /bíkṗà/ <bíkṗá> *1. (and) it stuck 2. (and) it pinched*
 b. /íló/ <íló> *may he/she throw away!*
 /ílò/ <íló> *throw away (pl.)!*
 /ílò/ <íló> *may he/she thatch!*
 /íló/ <íló> *thatch (pl.)!*

2. Literacy background

2.1 Literacy programs

In 1970, Tem was one of four languages (along with Ewe, Kabiye and Moba) that the Togolese Ministry of Social Affairs chose for promotion in non-formal education (Afeli, 2003, pp. 6–7, 128).²¹ Motivation among the Tem for L1 literacy is high in comparison with many other Togolese languages. Tem people see literacy as a way of preserving their cultural heritage and religious identity. Numeracy is attractive for those who were unable to complete their formal education in French. Preaching, whether in the mosques or on the radio, often occurs in Tem, so the translation of Qur'an passages has encouraged some to learn to read in Tem for religious purposes. Both the Arabic script and Roman script Tem orthographies are taught at some mosques in Sokodé.

Starting in the 1980s, literacy classes were organized by the government, SOTOCO (*Société Togolaise du Coton*) and SIL. In 2005, six development organizations formed a cooperative called COPA (*Consortium des Organisations Professionnelles de l'Alphabétisation au Togo*). From 2007 until the time of our experiment, COPA received significant annual funding from a Swedish development agency to run literacy classes in about 70 Tem villages. Since 2010, ABTem (*Association Bible Tem*) has also run 20 additional classes, with the help of separate funding from the UK. Table 3 shows the graduation figures for the decade leading up to the experiment including COPA and ABTem classes.²² Levels 1–3 cover literacy and numeracy, while level 4 covers transition from Tem to basic French and a basic management component.

21. A less well-known fact is that, in 1973, Tem was also an early candidate for the status of “national language” (which, in the Togolese context, means a language promoted in formal education and the media) until, two years later, “Tem” was replaced by “Kabiye” – the language of Gnassingbé Eyadéma, then Head of State – in the government’s policy documents (Lange, 1991, p. 15).

22. Graduation figures for 2006 level 1, 2011 level 2, and 2012 level 3 are unobtainable. The reported figures are estimates based on enrolment figures for those years multiplied by 81%, representing graduation as a percentage of enrolment for 2017.

Table 3. Graduations in the Tem literacy programs

| | Level 1 | Level 2 | Level 3 | Level 4 | Post-literacy | French to Tem transition | Writers' workshops |
|--------------|-------------|-------------|-------------|-------------|---------------|--------------------------|--------------------|
| 2006 | 142 | – | – | – | – | – | – |
| 2007 | 421 | 108 | – | – | – | 25 | 42 |
| 2008 | 544 | 352 | 89 | – | – | 30 | 48 |
| 2009 | 271 | 625 | 404 | 99 | – | – | – |
| 2010 | 222 | 177 | 550 | 363 | 43 | – | – |
| 2011 | 590 | 101 | 164 | 495 | 291 | – | – |
| 2012 | 321 | 362 | 101 | 163 | 657 | 25 | – |
| 2013 | 499 | 270 | 320 | 122 | 628 | – | – |
| 2014 | 535 | 453 | 264 | 345 | 531 | 26 | 75 |
| 2015 | 371 | 409 | 413 | 237 | 319 | – | – |
| TOTAL | 3916 | 2857 | 2305 | 1824 | 2469 | 106 | 165 |

2.2 Literature production

Tem publications include booklets on health, nutrition, agriculture, commerce, citizenship, domestic violence, numeracy, management, trauma healing, environmental issues, human rights, folktales, biographies, brief histories of over 25 Tem villages, annual calendars and a guide to using them, an explanation of Muslim prayer rituals, a series of eight simple reading books translated from Anii (a neighboring language), translation of several portions of the Qur'an, the New Testament with accompanying study guides, and, sporadically, a newspaper. Under COPA, book production has seen an increase through 2019. Each of the six development organizations produces a new booklet annually, and the whole set becomes available to the others, as well as to the portable village libraries that accompany each literacy class. Various websites promote written Tem,²³ of which the most active are *Parlons Tem*, the public Facebook group (see footnote 5), *Tem Biya*, a WhatsApp broadcast group, and *Đíjímáti Tem*, a Telegram group. A Tem Android keyboard was developed by SIL in 2017 allowing people to use Tem on Android and iOS cell phones for Facebook and WhatsApp messages.

23. <http://www.tembiya.net> includes articles in Tem, French and English (posts from 2015–2017); <http://linguistiqueetlanguesafricaines.blogspot.com/> (posts are from 2009–2013); <http://kotokoli.blog.free.fr/> (posts are from 2009); <http://temlaado.unblog.fr/> (posts are from 2006); All listed sites were accessed 26 January 2021.

2.3 Pedagogical materials

Tem pedagogical materials include a guide to Tem grammar and spelling rules (De Craene & Tchagbra, 1996a, 1996b, 1997b, 1997c, 1998) and a language and culture learning course for foreigners learning Tem (Der-Houssikian, 1980a, 1980b, 1980c).

2.3.1 Literacy primer

Three Tem literacy primers are in existence. The first was published by the government in the early days of standardization (MAS, 1986) and is rarely, if ever, used nowadays. The second (Kordow, 2007) is a rare example of a digraphic publication that teaches people to write Tem in Arabic script as well as in Roman script. The third (De Craene et al. 2008)²⁴ is more widely used and is the focus of the following evaluation. It is preceded by a pre-primer (De Craene 2013) which is geared towards the teaching of sight words. Although words are marked for tone, nothing in this publication indicates a focus on tone awareness.

In the first five lessons of the primer itself, tone is not in focus although the two keywords used for lesson 1 have the same tone pattern. The syllable derived from the keyword drops the acute accent marking H, so the drills are all “tone neutral.” However, tones are written on built words, grammar drills, and in the story. At this point in the primer, the grammar drills are solely of the analysis/synthesis type, and most lessons do not have any grammar drills at all.

However, from lesson six, which teaches the H tone mark, tones are written in the drill boxes. Sometimes these include tonal minimal pairs, but these lessons include no explicit tone drills (Figure 3).


| | | | | | | | | | | | | | |
|---|--|-------|--------|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|
| 6 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| <table border="0"> <tr> <td>naánt</td> <td>naánt</td> </tr> <tr> <td>naá</td> <td>naa</td> </tr> </table> | naánt | naánt | naá | naa | | | | | | | | | |
| naánt | naánt | | | | | | | | | | | | |
| naá | naa | | | | | | | | | | | | |
| <table border="1"> <tr> <td>naa</td> <td>nu</td> </tr> <tr> <td>naá</td> <td>ní</td> </tr> </table> | naa | nu | naá | ní | | | | | | | | | |
| naa | nu | | | | | | | | | | | | |
| naá | ní | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |
| | <table border="0"> <tr> <td>naaná</td> <td>waana</td> </tr> <tr> <td>na</td> <td>na</td> </tr> </table> | naaná | waana | na | na | | | | | | | | |
| naaná | waana | | | | | | | | | | | | |
| na | na | | | | | | | | | | | | |
| | <table border="1"> <tr> <td>na</td> <td>na</td> <td>naá</td> <td>naa</td> </tr> <tr> <td>ba</td> <td>ba</td> <td>baá</td> <td>baa</td> </tr> <tr> <td>wá</td> <td>wa</td> <td>wáá</td> <td>waa</td> </tr> </table> | na | na | naá | naa | ba | ba | baá | baa | wá | wa | wáá | waa |
| na | na | naá | naa | | | | | | | | | | |
| ba | ba | baá | baa | | | | | | | | | | |
| wá | wa | wáá | waa | | | | | | | | | | |
| | <table border="0"> <tr> <td>baabá</td> <td>waabáa</td> </tr> <tr> <td>baa</td> <td>báa</td> </tr> </table> | baabá | waabáa | baa | báa | | | | | | | | |
| baabá | waabáa | | | | | | | | | | | | |
| baa | báa | | | | | | | | | | | | |
| | <table border="1"> <tr> <td>baa</td> <td>báá</td> <td>báa</td> </tr> <tr> <td>naa</td> <td>naá</td> <td>naa</td> </tr> <tr> <td>waa</td> <td>wáá</td> <td>wáa</td> </tr> </table> | baa | báá | báa | naa | naá | naa | waa | wáá | wáa | | | |
| baa | báá | báa | | | | | | | | | | | |
| naa | naá | naa | | | | | | | | | | | |
| waa | wáá | wáa | | | | | | | | | | | |
| | <p>Agóro waana naánt. Naánt na Agóro tna naánt né, naánt wánnáa yt.</p> | | | | | | | | | | | | |
| | 13 | | | | | | | | | | | | |

Figure 3. Tem lesson introducing the acute accent to mark H tone (De Craene et al., 2008, pp. 12–13)

24. The first edition of De Craene’s literacy primer appeared in 1984.

The literacy program coordinator and others involved with the program²⁵ confirm that classes do not focus on tone. However, each review lesson does organize syllables according to tone patterns. For example, lesson 10 has syllables with the following patterns in columns: CV, CV́, CV́V́, CVV and CVV́.

Given that Tem has mobile tone, explicit tone drills themselves are probably not as helpful as they would be for a language with primarily stable tone. Instead, it would be preferable to include drills that explicitly compare grammatical tonal minimal pairs.

2.3.2 *Transition guide*

Two transition guides exist for Tem speakers already literate in French (De Craene & Tchagbra, 2009; MAS & SIL, 1981); this section will evaluate the most recent of these.²⁶ It is geared towards Tem who only want to read their language, not to write it. Although the accents are mentioned in the introduction, and although they do appear in lesson 1 (which teaches vowel length) they are not identified as marking H tone until lesson 2, where they are specifically taught (Figure 4).

Three sets of tonal minimal pairs are given to teach the need for the accent, but unfortunately they are not easily picturable (all but one of the six words is a verb); one of the pairs is used for the first revision lesson. The interaction of tone and vowel length is then presented with a four-way tonal contrast, still predominantly using verbs. After a reminder to pause reading at a period instead of at the end of a line,²⁷ a two-sentence reading exercise is given. For writing, learners are told to copy the sentences in their notebooks and to practice reading what they have written. That is the only kind of writing exercise in the book, and is done at the end of every lesson.

Tem has significant grammatical tone (see p. 36), so the last four lessons of the book deal with grammar. It is in this section that students learn that <n> can be an orthographic TBU, in lessons 11, 12, and 13. In lesson 11, it carries a L tone, indicating imperfective aspect, while in lesson 12 it carries a H tone, indicating the iamative (which, the guide explains, means “already”). Lesson 13 uses the term “syllabic n” to introduce the morpheme /n/ *you, your* which is attached to the verb or noun. A list of other words beginning with a syllabic n is then given. Each lesson is followed by a story that gives ample practice with the use of syllabic n in the environment(s) just presented. In lesson 15, other “technical details” are mentioned,

25. Yaminou Tchakondo Gandè (executive director of COPA), Ouro-Agouda Abdel Aziz (Literacy Supervisor), and Agrignan Koubonou (ABTem Scripture Use Promoter).

26. This publication also exists in a Braille version (De Craene & Tchagbra, 1997a) which is beyond the scope of our evaluation.

27. This may seem curious advice, but experience has shown that even those literate in French frequently ignore punctuation in oral reading and in writing.

Leçon 2

En Tem, l'accent aigu (´) indique le ton haut, c'est là où la voix monte.

| | | |
|--------------|-----------------------------|-----------|
| waama | <i>il a construit</i> | ma |
| waamá | <i>il a frappé</i> | má |
| baaya | <i>ils se sont dispersé</i> | ya |
| baayá | <i>ils ont vendu</i> | yá |

| | | |
|--------------|-------------------|-----------|
| baana | <i>ils ont vu</i> | na |
| baaná | <i>colère</i> | ná |

Pour les doubles voyelles, il existe 4 possibilités:

| | | | |
|------------|------------------|-----------|----------|
| yaa | <i>appelle!</i> | aa | a |
| yáá | <i>ou bien</i> | áá | á |
| yáa | <i>disperser</i> | áa | |
| yaá | <i>appeler</i> | aá | |

Lecture: Naaná waana náánt. Naant na naaná una náánt né, náánt wáánáa yt.

Remarque: En lisant, il faut s'arrêter là où il y a un point ou une virgule. Il ne faut pas s'arrêter à la fin de la ligne.

Écriture: Copier plusieurs fois les exemples ci-dessus, puis s'entraîner à les écrire sans regarder le modèle.

Figure 4. Initial tone lesson in the Tem transition guide (De Craene & Tchagbra, 2009, pp. 4–5)

including places where tone is never written, such as object pronouns and other particles that may be H or L depending on context. The authors also note that tone is written on capital letters as well as small letters, which students have already seen in the reading exercises.

As noted earlier, this transition guide is only intended to teach the reading of Tem. Those who wish to become proficient writers participate in a writers' workshop where they are taken through a series of booklets (De Craene & Tchagbra, 1996a, 1996b, 1997b, 1997c, 1998) to help authors write Tem well. The extremely brief presentation of features and single type of reading exercise indicates that this guide is designed either for independent use by the very well educated or for use in class where a teacher can add activities; it has also been taught through a radio program. One clear weakness of this transition guide is that students have no way to self-check the accuracy of their reading, as no translations of the reading exercises for students are included in the book.

Nateni (*David Roberts, JeDene Reeder*)

1. Linguistic and orthographic background

1.1 Affiliation and location

Nateni¹ is a Gurma Oti-Volta Gur language spoken in the Atacora department of north-western Benin, in a radius of about 30km around the village of Tayacou. A diaspora has spread to the Borgou department, and also to urban centers such as Parakou and Cotonou (Figure 1). Eberhard et al. (2020) estimate a population in 2018 of 102,000 Nateni speakers.

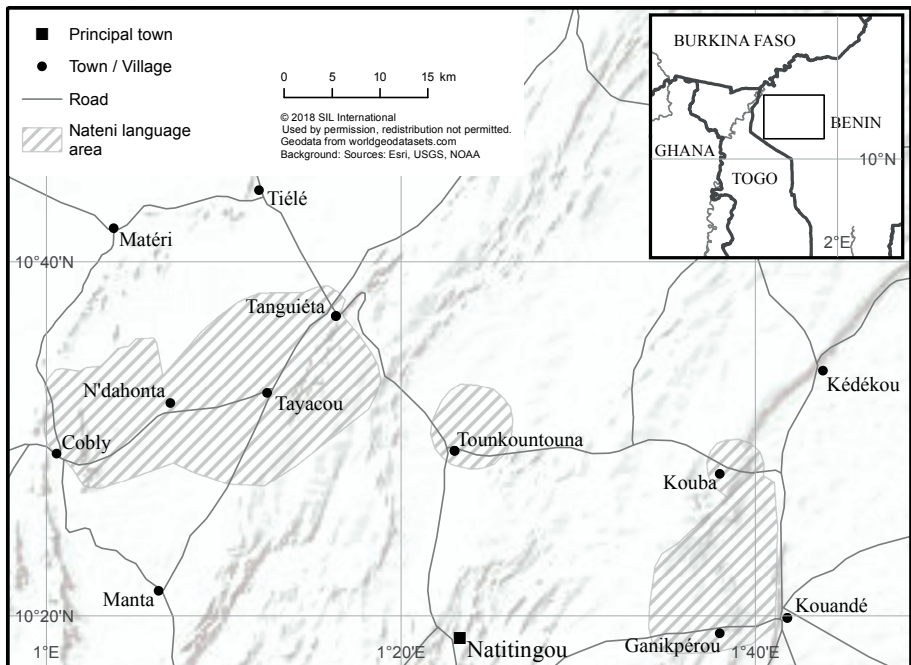


Figure 1. The Nateni language area

1. ISO 639-3: ntm. Glossonym: /näätènni/ <Naàtènni>. Ethnonym: sg. /näätènn/ <Naàtènn>; pl. /näätèmmā/ <Naàtèmma>.

Nateni has four main dialects:

- Tayari, the dialect with the most speakers, spoken in Tayacou, the principal Nateni village, in the commune of Tanguiéta. The Commission Nationale Linguistique Naténi chose this as the reference dialect for orthography development (Nédellec 2006, p. 36).
- Kunténi, spoken in N’dahonta and as far as the communes of Cobly and Matéri;
- Strict Nateni, the dialect from which the entire language group gets its name, spoken in the village of Toucountouna, about 30km south-east of Tayacou (Nédellec 2006, p. 16).
- Okoni, the dialect most different from the others, spoken in the region of Orou-Kayo, about 100km south-east of Tayacou, in the commune of Kouandé.

1.2 Orthography development

Reineke (1983, p. 10) mentions a “Séminaire national de recherches et de transcription de la langue naténi”, organized as a result of President Mathieu Kérékou’s 1972 initiative to promote all of Benin’s minority languages. In spite of this, Nateni was written haphazardly at first. Spelling tended to be influenced by the dialect of the writer and often varied within one text. So, in 1991, SIL organized two meetings, in Cotonou and Natitingou, inviting the *Commission Nationale de Langue Naténi* and other orthography stakeholders with a view to standardizing the orthography.

The report (Bukies & Winrikou, 1991) stresses the ongoing nature of the spelling debate, and the challenges of developing a standard orthography for a language whose four dialects differ in the following respects.

Lexicon: a common lexical stock exists to which each of the dialects add their own words, often borrowed from neighboring languages such as Baatonum, Waama, Mbelime and Byali. The report recognizes that, although it would be ideal for teaching materials to limit themselves to this stock, in practice no one can prevent other words from being used. It suggests that this practice may gradually have an enriching effect as learners absorb words they would not otherwise have encountered. Nédellec (2006, p. 16) considers Okoni to be the dialect most lexically distinct from the others.

Grammar: The report identifies the Kunténi dialect as having distinct particles. But speakers understand Tayari, whereas others often do not understand them. So it recommends that the orthography be based on Strict Nateni, Okoni and Tayari.

Phonology: The report states that Strict Nateni and Okoni are closer to each other than they are to the other dialects, and closer to each other than the other dialects are to each other. Fortunately, most of the differences are merely phonetic, allowing a unified spelling for all four dialects.

A later document (Nédellec & Seifert, 2000) provides specific examples. Orthography decisions tend to be initiated by the Bible translators, since they are the only Nateni literates who are faced with spelling issues on a day-to-day basis. In principle, any proposal for reform is then discussed with representatives of the literacy associations and submitted for final approval at the triennial meeting of the *Commission Nationale de Langue Naténi*. In practice, however, the translators have sometimes incorporated orthography changes into the revision of literacy materials, bypassing other stakeholders.

Figure 2 shows a text written in the standard Nateni orthography to show the visual effect of full tone marking.²

Hòṣta nà mòṣta-dà de dópú, è té ncenti è nṓ. Kà daadí pedá, kà pá tódá ṭakadáma è yò pá tódá pídi é taá dèèdèka yóópú. Kà pá yídá hòṣta é kaḥá, é tēi ye tená yèdi pesá, kà hòṣta é caka mòṣta è yò: Mmí yòh-mà sṭhnmṓhn è tṭmà césí téná disimá, mmí-dà kó ḍisi tepú hṭnka, kà fṣí ní n'neèhi teṅka è ṭankú tebṭíká, è kà tàni pídi meheká.

Figure 2. Nateni written with full tone marking (Standard orthography)

1.3 Previous research

The first published mention of Nateni is in a brief article about 14 Gur languages of the region (Bertho, 1949), followed a generation later by an overview of the language (Prost, 1972) and a comparative reconstruction (Manessy, 1975). But it was Brigitte Reineke who really opened up the field. She investigated the grammar (Reineke, 1983), the phonology and tonology (Reineke, 1985), nominal morphology (Reineke, 1987), verbal morphology (Reineke, 1995), and relative constructions in a comparative framework (Reineke, 1998).

Nateni linguistic research continued to diversify with the publication of a 2300 word Nateni-French lexicon (Winrikou, Bukies, & Neukom, 1994), a descriptive grammar (Neukom, 1995), as well as papers on clause-combining (Neukom, 2003) and the disappearance of the palatal stop (Nédellec, 2003). More recent publications include a study of qualification strategies (Nédellec, 2006), another phonological analysis (Nédellec & Bukies, 2008), and a presentation of the noun class system (Reineke, 2012).

2. For the origin of this text and a free English translation, see p. 30, footnote 8.

The grapheme <k> is sometimes pronounced voiced [g] intervocally (3a, 3b), but the orthography guide does not offer any rule explaining the predictability. The grapheme <k> is also pronounced voiced before a nasal (3c), except in reduplicated forms (3d) and compounds (3e; Winrikou & Koudi, 2010, pp. 9–10).

- | | | | | |
|--------|------------|--------------|------------|------------------------|
| (3) a. | /míkū/ | → [míkū] | <míku> | <i>blade of grass</i> |
| b. | /tākā/ | → [tāgā] | <tàka> | <i>mangoes</i> |
| c. | /bāñkà/ | → [bāngà] | <bankà> | <i>approach gently</i> |
| d. | /kàñkāmū/ | → [kàñkāmū] | <kàñkàmu> | <i>census</i> |
| e. | /kàñkántō/ | → [kàñkántō] | <kàñkántō> | <i>farmer</i> |

The grapheme <t> is pronounced voiced [d] after a nasal (4a), except in reduplicated forms (4b) and compounds (4c; Nédellec & Bukies, 2008, pp. 9–13; Winrikou & Koudi, 2010, pp. 8–9).

- | | | | | |
|--------|-----------|-------------|-----------|----------------------|
| (4) a. | /māntā/ | → [māndā] | <mañta> | <i>panther</i> |
| b. | /tāñtāññ/ | → [tantaññ] | <tantaññ> | <i>trader</i> |
| c. | /tēñtēpá/ | → [tēñtēpá] | <tentepá> | <i>grafted mango</i> |

According to Winrikou & Koudi (2010, p. 11), the letter <d> is pronounced in various ways depending on the dialect of the reader, and readers are encouraged to remain faithful to their dialect. In the Tayari (reference) and Strict Nateni dialects <d> is pronounced [d] or [l] in word initial position⁴ (5a), and as [r] (5a) or [l] (5b) when it is the onset of the final syllable.

- | | | | | |
|--------|---------|-------------------|---------|------------|
| (5) a. | /dāādí/ | → [dāārí ~ lāārí] | <daadí> | <i>day</i> |
| b. | /tādí/ | → [tālí] | <tadí> | <i>go</i> |

In the Okoni dialect, the letter <d> is always pronounced [d] in word initial (6a) and medial (6b) positions, and as [r] (6a) or [t] (6c) when it is the onset of the final syllable.

- | | | | | |
|--------|----------|------------|----------|-----------------|
| (6) a. | /dāādí/ | → [dāārí] | <daadí> | <i>day</i> |
| b. | /kódātá/ | → [kódātá] | <kódatá> | <i>cockerel</i> |
| c. | /fōkādá/ | → [fōkātá] | <fokadá> | <i>pull up</i> |

In the Kuntani dialect, <d> is pronounced [d] in all positions⁵ (7a, 7b), but may be pronounced as [r] when it is the onset of the final syllable (7b).

4. Winrikou & Koudi (2010, p. 11) state that <d> may also pronounced [d] or [l] in medial position, but provides no example in which a word medial <d> is not also the onset of a final syllable.

5. Winrikou & Koudi (2010, p. 11) provide no example of a word medial <d> which is not also the onset of a final syllable.

- (7) a. /dāādí/ → [dāādí] <daadí> *day*
 b. /didā/ → [dirā] <diida> *open (eyes)*\NEU

The nasals [m, n] are allophones of the phonemes /b, d/ before nasal vowels. But the graphemes <m, n> are maintained in the orthography because of the independent existence of a preconsonantal syllabic nasal /N/ the place of articulation of which is homorganic to that of the following consonant. The syllabic nasal is written <m> before <b, f>, and <n> elsewhere. This, in turn, led to the decision to write <m, n> (instead of <b, d>) before nasal vowels, and in such cases the tilde is not written under the latter (8; Nédellec & Bukies, 2008, pp. 10, 12, 25–27; Winrikou & Kouidi, 2010, p. 10).

- (8) a. /nēmá/ <néemá> *water*
 b. /màmàkū/ <màmàku> *elephant*
 c. /nāñfā/ <nañfa> *scorpion*

Nasal spreading on vowels is blind to the presence of an intervocalic glottal fricative /h/. In such cases, the tilde is only marked on the first vowel (9; Winrikou & Kouidi, 2010, p. 12).

- (9) a. /kāhā/ <kaḥá> *leave*
 b. /yāhī/ <yāhi> *be acidic*
 c. /mēhēká/ <meheká> *inside, in, stomach*

Geminate nasals <mm, nn> in adjectival phrases (10a, 10b) and compounds (10c, 10d) are the result of the juxtaposition of a nasal and a stop. The first component of the geminate is a syllabic nasal – and therefore bears its own tone – and the second is a syllable onset. These processes are written transparently.

- (10) a. /pòpò-dī sìmóh-dī/ → [pòpòsìmóhñi] <pòpòsìmóhñi> *small*
 motorbike-sx small-sx *motorbike*
 b. /nàà-dī sìmóh-dī/ → [nààsìmóhñi] <nààsìmóhñi> *small*
 millstone-sx small-sx *millstone*
 c. /yōh-kū mí-ti/ → [yōmmíti] <yōmmíti> *July*
 field-sx grass-sx
 d. /nù-dī máná-dī/ → [nūmmánádi] <nuømmánádi> *fasting*
 mouth-sx tie-sx

The phoneme /kp/ is pronounced with a soft release, at least in the Tayari (reference) dialect, often even tending towards [k^w].

The phoneme /j/ is dying out, merging with /y/ before oral vowels and [n] before nasal vowels, hence the written representations <y, n> (Nédellec 2003; Nédellec & Bukies 2008, pp. 12–13, 17).

The main contribution of the 1991 orthography reform is that it simplifies previous writing practice, eliminating the following superfluous letters:

- the graphemes <l, d̥, r>, because, depending on the dialect of the speaker, [d ~ d̥ ~ l] are in free variation word initially, and [l ~ d̥ ~ r] intervocalically; all are allophones of the phoneme /d/ (Bukies & Winrikou 1991, p. 6; Nédellec & Bukies 2008, pp. 27–29);⁶
- the practice, especially in the Tayari and Kunteni dialects, of spelling out labialized consonants as <Cw> before [o, ɔ, ɔ̃] and palatalized consonants as <Cy> before [e, ε, ē], (Bukies & Winrikou 1991, pp. 9–10; Nédellec & Bukies 2008, pp. 22–23);
- the digraph <ny> representing the palatal nasal [ɲ], because it is an allophone of the phoneme /ɲ/ (which in turn is merging with /y/) in nasal environments. Nevertheless, the reformers maintain the graphic sequence <ny> to represent the syllabic nasal before the palatal approximant /ɲy/ (Bukies & Winrikou 1991, pp. 10–11; Nédellec & Bukies 2008, pp. 12–13).
- the graphemes <ŋ, ŋm> representing the pronunciation of the preconsonantal syllabic nasal /ŋ/ before /k, kp/, respectively; instead they are written with <n> (Bukies & Winrikou 1991, pp. 25–27; Nédellec & Bukies 2008, p. 10).

1.6 Vowels

Table 2 presents the vocalic grapheme-phoneme correspondences in the 1991 orthography.

Table 2. Nateni vocalic grapheme-phoneme correspondences (based on Nédellec & Bukies 2008, p. 16; Neukom 1995, p. 4)

| | Oral | | Nasal | |
|-----------|-------|------|-------|-------|
| | Front | Back | Front | Back |
| Close | i | u | ĩ <ɨ> | ũ <u> |
| Mid-close | e | o | | |
| Mid-open | ε | ɔ | ē <ε> | ō <ɔ> |
| Open | a | | ã <a> | |

6. None of the published research (Nédellec, 2006; Nédellec & Bukies, 2008; Neukom, 1995) mentions [d̥] as an allophone of /d/.

In all cases, the graphemes match their corresponding IPA symbols, except that the tilde signaling nasality is written subscript rather than superscript to avoid diacritic stacking when tone is marked. Long vowels are written by doubling the vowel.

The 1991 reformers eliminated a superfluous grapheme <ə>, because the schwa [ə] was found to be an allophone of the short front vowels /i, e, a/ interconsonantly (Bukies & Winrikou 1991, p. 8; Nédellec & Bukies 2008, pp. 3–5).⁷

1.7 Tone

1.7.1 *Tone orthography*

Nateni has three discrete level tones, H, M, and L. Tones occur on V, and on N in preconsonantal and word final position. The tone system is almost entirely stable: contextual words match isolation forms.

The 1991 reformers made the decision to mark tone fully, writing H with an acute accent, L with a grave accent and M with absence of an accent (Bukies & Winrikou, 1991). It is unclear whether this was a new departure or simply a ratification of existing practice, but it is in line with Beninese government recommendations for three-tone languages (CENALA, 2011, pp. 3–4).

The 1991 reform advocates writing tone and nasality in superscript position <◌̄, ◌̇> (Bukies & Winrikou 1991, p. 17), but almost straightaway this practice was called into question. Bukies (1992, p. 3) presents two subscript options for nasality, the cedilla <◌̣, ◌̤>, and the tilde <◌̃, ◌̄̃>, with the aim of avoiding diacritic stacking. By the time the first teaching materials were produced (CENALA & SIL 1993/2010a), opinion had swung in favor of the latter, and by now this has become the norm.

1.7.2 *Contour tones*

Contour tones may occur on single vowels. The orthography represents these as long vowels even though they are pronounced as short vowels, and even though vowel length is contrastive (11).

- | | | | | | |
|------|----|------|--------|----------|-------------------|
| (11) | a. | HL-M | /h̄tā/ | <h̄t̃a> | <i>house</i> |
| | b. | ML-M | /bòdā/ | <bòd̃a> | <i>knock</i> \NEU |
| | c. | HM-H | /n̄má/ | <n̄ém̃a> | <i>water</i> |

7. Bukies & Winrikou (1991, p. 8) refer to this environment as “syllabes non-accentuées” (unstressed syllables).

Table 3. Subject pronouns and possessive pronouns
(based on Winrikou & Kouidi, 2010, pp. 28–29)

| Subject pronouns | | | Possessive pronouns | | |
|------------------|------|-----------|---------------------|------|-------------|
| /ò/ | <ò> | he/she/it | /ō/ | <o> | his/her/its |
| /pà/ | <pà> | they | /pā/ | <pa> | their |

More extensive is the prominent role of tonal inflection in the verb system, which either distinguishes conjugations uniquely, or in combination with segmental inflection. Verbs are also characterized by segmental alternations at the root-suffix morpheme boundary, but any correspondence between these and tonal inflection is very limited. Nateni has three major verb conjugations: Neutral,¹⁰ Perfective and Imperfective. The following account is based on Neukom (1995, pp. 5–34, 46, 142), who presents tonal inflection in terms of replacive grammatical tone, while admitting the possibility of tonal suffixes, since it is almost always the tone of the last syllable that changes.

Some monosyllabic verbs conjugate only by tonal inflection. Five tone patterns emerge. The Neutral and Perfective are homophonic except in one case; the Imperfective is marked by a L tone tonal suffix (Table 4).¹¹

Table 4. Monosyllabic verbs: Tonal inflection (based on Neukom 1995, p. 18)

| Tone patterns | | | Pronunciation | | | Orthography | | | |
|---------------|-----|-----|---------------|-----|------|-------------|-----|------|-----------------|
| NEU | PER | IPF | NEU | PER | IPF | NEU | PER | IPF | |
| HH | HH | HL | /mēí | mēí | mēi/ | <mēí | mēí | mēi> | <i>forge</i> |
| MH | MH | ML | /dṣṣ | dṣṣ | dṣṣ/ | <dṣṣ | dṣṣ | dṣṣ> | <i>lie down</i> |
| MM | MM | ML | /kēī | kēī | kēi/ | <kei | kei | kei> | <i>harvest</i> |
| MLM | LM | LL | /dēñ | dēñ | dēñ/ | <deèn | dèn | dèn> | <i>sing</i> |
| LM | LM | LL | /sṣṣ | sṣṣ | sṣṣ/ | <sṣṣ | sṣṣ | sṣṣ> | <i>hide</i> |

Other monosyllabic verbs conjugate by tonal and segmental inflection. The Neutral and Perfective have the same segments, and in most cases the same tone patterns. The Imperfective, on the other hand, takes a suffix /-i ~ -u/, the alternation depending on certain conditioning factors. Neukom identifies nine patterns (Table 5).¹²

10. The Neutral is the citation form, which is also used for the Infinitive, the Aorist and the Imperative. Neukom (1995) considers it to be the most basic form of the verb.

11. The forms for “forge” are found in the Tayacou dialect.

12. The forms for “forge” are found in all dialects except Tayacou.

Table 5. Monosyllabic verbs: Tonal and segmental inflection (based on Neukom 1995, p. 19)

| Tone patterns | | | Pronunciation | | | Orthography | | | |
|---------------|-----|-----|---------------|------|--------|-------------|------|--------|----------------|
| NEU | PER | IPF | NEU | PER | IPF | NEU | PER | IPF | |
| HH | HM | HM | /kpíí | kpî | kɔ̃n/ | <kpíí | kpíí | kɔ́n> | <i>die</i> |
| HH | HL | HL | /máí | mâi | mâi/ | <máí | mâi | mâú> | <i>forge</i> |
| HM | HM | HHM | /tón | tón | tónti/ | <tón | tón | tónti> | <i>leave</i> |
| MH | MH | MM | /háá | háá | hɔ̃ú/ | <háá | háá | hɔ́u> | <i>dance</i> |
| MH | ML | MM | /nēdá | nēdà | nɔ̃n/ | <nedá | nedà | nɔ́n> | <i>be able</i> |
| MM | MM | MM | /hīn | hīn | hɔ̃n/ | <hīn | hīn | hɔ́n> | <i>do</i> |
| MM | MM | ML | /bī | bī | bīú/ | <bii | bii | biú> | <i>ripen</i> |
| LM | LM | LL | /māā | māā | mɔ̃ù/ | <māā | māā | mɔ́ù> | <i>wrestle</i> |
| LL | MM | MMM | /kòn | kūn | kūnti/ | <kòn | kun | kuntì> | <i>go home</i> |

Similarly, some 60 disyllabic verbs in Neukom's database conjugate by tonal inflection alone. Four tone patterns emerge (Table 6).

Table 6. Disyllabic verbs: Tonal inflection (based on Neukom 1995, pp. 21–22)

| Tone patterns | | | Pronunciation | | | Orthography | | | |
|---------------|-----|-----|---------------|-------|--------|-------------|-------|--------|-------------------|
| NEU | PER | IPF | NEU | PER | IPF | NEU | PER | IPF | |
| HH | HH | HL | /dídí | dídí | dídì/ | <dídí | dídí | dídì> | <i>cling to</i> |
| MH | MH | ML | /kɔ́dí | kɔ́dí | kɔ́dì/ | <kɔ́dí | kɔ́dí | kɔ́dì> | <i>cut (hair)</i> |
| MLM | LM | LL | /dɔ́dì | dòdì | dòdì/ | <dɔ́dì | dòdì | dòdì> | <i>furrow</i> |
| LM | LM | LL | /pùdì | pùdì | pùdì/ | <pùdì | pùdì | pùdì> | <i>fly away</i> |

Other disyllabic verbs conjugate by tonal and segmental inflection, but the Neutral and Perfective are still segmentally identical, and may be tonal minimal pairs or homophones. Neukom identifies nine patterns (Table 7).

Table 7. Disyllabic verbs: Tonal and segmental inflection (based on Neukom 1995, pp. 25–26)

| Tone patterns | | | Pronunciation | | | Orthography | | | |
|---------------|-----|-----|---------------|-------|--------|-------------|-------|--------|-----------------------|
| NEU | PER | IPF | NEU | PER | IPF | NEU | PER | IPF | |
| HH | HL | HL | /bédá | bédà | bépù/ | <bédá | bédà | bépù> | <i>turn around</i> |
| HH | HH | HL | /hácí | hácí | hákù/ | <hácí | hácí | hákù> | <i>rub</i> |
| HH | HL | HH | /wédá | wédà | wéhú/ | <wédá | wédà | wéhú> | <i>whisper</i> |
| MH | ML | MML | /tówá | tówà | tōōnì/ | <tówá | tówà | toonì> | <i>cause to carry</i> |
| MH | ML | MH | /wūdú | wūdù | wūhú/ | <wudú | wudù | wuhú> | <i>chew</i> |
| MH | MH | ML | /cōcí | cōcí | cōkù/ | <cocí | cocí | cokù> | <i>run</i> |
| MLM | LLL | LLL | /fìḡwā | fìḡwà | fìḡnì/ | <fìḡwā | fìḡwà | fìḡnì> | <i>replace</i> |
| MLM | LL | LM | /còdā | còdà | còhū/ | <còḡda | còdà | còhu> | <i>chop (once)</i> |
| MLM | LLM | LL | /hēntā | hēntā | hēmù/ | <heñta | hēntā | hēmù> | <i>wake up</i> |

2. Literacy background

2.1 Literacy programs

We have been able to obtain information about two Nateni literacy programs: Titoua, a local NGO, and APSEN (*Association pour la Promotion des Saintes Écritures en Naténi*), a nascent local association targeting local churches.¹³ Both courses offer three levels. In level one, participants learn the alphabet and basic reading skills; in levels two and three, they improve their reading fluency and do simple math. Each level takes 4–6 months, meeting two or three times a week for two-hour lessons. A separate transition track is offered for those already literate in French, the official language of Benin, which usually takes the form of an intensive 3–5 day course. Participants learn the basics of how to read and write Nateni, but require much more practice to become fluent. Table 8 shows annual enrolment and graduation figures in the APSEN (2009–2014) and Titoua (2015) literacy programs.¹⁴

Table 8. Enrolments and graduations in the Nateni literacy programs

| | Level 1 | | | Level 2 | | | Level 3 | | |
|--------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------------|------------|
| | Enrolled | Tested | Passed | Enrolled | Tested | Passed | Enrolled | Tested | Passed |
| 2009 | 55 | 42 | 29 | – | – | – | – | – | – |
| 2010 | 318 | 212 | 163 | – | – | – | – | – | – |
| 2011 | 169 | 88 | 80 | 149 | 85 | 72 | – | – | – |
| 2012 | 252 | 183 | 183 | 228 | 180 | 180 | – | – | – |
| 2013 | 175 | 135 | 114 | 123 | 101 | 86 | 75 | 50 | 44 |
| 2014 | 31 | 31 | 30 | 216 | 190 | 186 | – | – | – |
| 2015 | 1013 | 910 | 772 | 605 | 565 | 494 | 741 | 686 | 589 |
| Total | 2013 | 1601 | 1371 | 1321 | 1121 | 1018 | 816 | 736 | 633 |

On average, 88% of those who take the exams pass them, but only 78% of those who enroll in the course get as far as taking the exam, so the real challenge is combating abandonment rates. These tend to be higher in level 1 than in subsequent levels, and individual exam success rates are higher in levels 2 and 3.

13. An SIL literacy program began soon after the orthography was standardized but was discontinued. Jurafrigue, another NGO, has also been involved in literacy, but we have no information about their activities.

14. The 2015 figures for the Titoua program are from N'sera (2015). Figures for other years are unobtainable. The reduced enrolment rate for level 1 of the APSEN program in 2014 was intentional as the organizers' aim was to focus on improving the reading skills of those in the higher levels (Lois Dozeman, p. c.).

2.2 Literature production

Orthography standardization has led to a flourishing of publications in Nateni, including a literacy primer (Winrikou & Wiesemann, 2008),¹⁵ a writing guide in two volumes (CENALA & SIL, 1993/2010b, 1994/2013), a pre-primer (CENALA & SIL, 1993/2010a),¹⁶ a simple reading book (CENALA & SIL, 1995/2013), and a transition guide (Winrikou & Kouidi 2010).¹⁷

Currently available publications include a math course, booklets on health and rural development,¹⁸ a devotional booklet, a cartoon version of the life of Jesus, and a single publication combining Genesis and the New Testament. A newspaper was published for a short period in the 1990s, and there have been occasional calendars. Literature production was given a boost in 2014 with a multilingual writers' workshop organized by SIL in Tanguiéta, which included Nateni participants and resulted in the publication of seven new Nateni booklets containing stories, folktales, moral advice and explanations of local customs. In 2015, APSEN created a website¹⁹ to promote Nateni language and culture.

2.3 Pedagogical materials

2.3.1 *Primer*

The Nateni pre-primer (CENALA & SIL, 1993/2010a) includes visual discrimination exercises of syllables and words that have accents to mark tone. The primer (Winrikou & Wiesemann 2008) begins with several pages focusing on auditory discrimination of tone through the use of pictures and tonal minimal pairs. Each of these pages shows a box of three words containing the contrastive words just learned following each pair (or triplet), and concludes with a box of nine words containing the focal pair or triplet.

This primer includes syllables with tone marks in all the drills for lessons that teach segments. However, contrary to usual practice with the Gudschinsky method (Lee, 1982), the first syllable of the synthesis drill is not always identical to that of the analysis drill; often the sole difference is the tone mark (Figure 3).

15. The first edition of this literacy primer appears to be CENALA and SIL (1992), but we have been unable to obtain a copy to verify this.

16. In practice, the pre-primer was rarely used and is now out of print.

17. The first edition of this transition guide appears to be (CENALA & SIL, 1994/2010), but we have been unable to obtain a copy to verify this.


18. One of these is noteworthy because the writers took the unusual decision to have it published with no tone marking “for experimental reasons”.

19. www.nateni.info (accessed 29 March 2021).

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Figure 3. Nateni synthesis and identification drills (Winrikou & Wiesemann 2008, p. 16)

The review lessons also use tone marks in the syllable review drills and built word drills on the left-hand page. At the bottom of this page, the taught words are then organized according to tone pattern.

The use of tonal minimal pairs to teach tone awareness and the use of tone marks in all drills is a major positive factor of this primer. Another strength is the arrangement of taught words in the review lessons to help students hear how the tone patterns match in each column.

However, the rationale for using tone marks in the drills, but not respecting the one derived from the keyword in the analysis drill, is unclear and a major difficulty with this primer. The point of having that syllable be the same throughout the drills is to reinforce the new element of the analysis drill and permit independent reading of all the drills after the analysis drill based on the keyword. As it is, the combination of letters and tones into syllables seems random, making independent reading of the drills difficult if not impossible.

2.3.2 Transition guide

The Nateni transition guide (Winrikou & Kouidi, 2010) is the only one among those reviewed that follows Kutsch Lojenga's (1989, p. 33) recommendation to begin with a focus on tones. It is also the only one to follow Snider's (2018, p. 98) advice to focus on tone patterns. Not only are the three tones and their orthographic representation on vowels and syllabic nasals introduced, with examples, but then the sixteen tonal patterns found in Nateni are given (Figure 4). Each pattern has a keyword, and learners are encouraged to memorize these so that when writing, they can match the pattern of the word they want to write with one of these keywords and thus correctly write the tones. However, while Snider asserts that native speakers can identify patterns more easily than individual tones, Nateni learners are told that if they are unable to match a word to a pattern, they can just break the word into syllables to discover the individual tones. The lesson ends with three exercises: one to discover the tones on words, given their French translation; one to orally read syllables with tones marked on them; and one to match eleven words with the paradigmatic keywords.

The Nateni transition guide also has a large section discussing rules for writing, organized according to grammatical categories. When the distinction between two particles is tonal, as for example between personal pronouns and their possessive counterparts (see Table 3, p. 52), this is explicitly noted as each category is

En naténi, nous avons au total seize (16) schèmes tonales.
Chaque mot (verbes et noms) se retrouve dans l'une de ces schèmes à moins qu'il soit un mot composé ou un emprunt. Il y a lieu de maîtriser ses seize schèmes qui nous seront d'une grande utilité pour écrire les tons des autres mots. Nous avons ciblé certains mots comme standard pour représenter chaque schème.

| Mots commençant par le ton haut (') | Mots commençant par le ton bas (') | Mots commençant par le ton moyen (-) | | | |
|---------------------------------------|--------------------------------------|--|-------|---------------|--------|
| <i>marigot</i> | kóńkú | <i>ventre</i> | pèeci | <i>jour</i> | daadí |
| <i>casser en miette</i> | póháà | <i>boeuf</i> | nàfa | <i>dire</i> | cakáà |
| <i>eau</i> | néemá | <i>arranger</i> | dòháà | <i>tomber</i> | dódi |
| <i>casser en miette</i> | póha | <i>arranger</i> | dòhá | <i>penser</i> | mahà |
| <i>prendre</i> | tódà | | | <i>cogner</i> | boóda |
| <i>maison</i> | hòòta | | | <i>penser</i> | maàháà |

Figure 4. Tone patterns in the Nateni transition guide with keywords and their French translations (Winrikou & Kouidi, 2010, p. 4)

discussed. This section ends with a lesson focusing on two cases of grammatical tone: the L tone on the final syllable of nouns when the speaker wishes to refer to a previous mention of the noun, and the floating tone added to phrases on the final syllable of verbs to indicate certainty. Exercises in reading and writing are included at four points in the orthography rules section, covering all the topics found therein.

Although it is not specifically stated anywhere, and even though answers to exercises are included at the end, the Nateni transition guide appears to be designed for use in a classroom setting. The chief evidence for this is the inclusion of two dictation exercises. The preface states that an easy reading book is meant to be used in conjunction with the guide after the tones and letters are taught.

A major strength of the Nateni transition guide is its initial focus on tones and use of syllable exercises, even though it does not follow through on all of Kutsch Lojenga's recommendations as summarized on pp. 19–20. The explicit information on the tone patterns found in Nateni with the encouragement to use paradigmatic keywords to identify words with identical patterns is another strong point. Additionally, the inclusion of explicit instruction in grammatical tone is a major positive factor. However, for exercises subsequent to the first lesson, learners are never reminded to read or write tone, which is a minor weakness that transition course instructors may rectify in the classroom.

Mbelime

(David Roberts, Johannes Merz, JeDene Reeder)

1. Linguistic and orthographic background

1.1 Affiliation and location

Mbelime¹ is an Eastern Oti-Volta Gur language spoken in and around the communes of Cobyly and Boukombé in the Atacora department of north-western Benin, as well as in a small area in neighboring Togo (Gblem-Poidi & Kantchoa, 2012, p. 258) (Figure 1). In addition, a diaspora has spread to the Borgou department

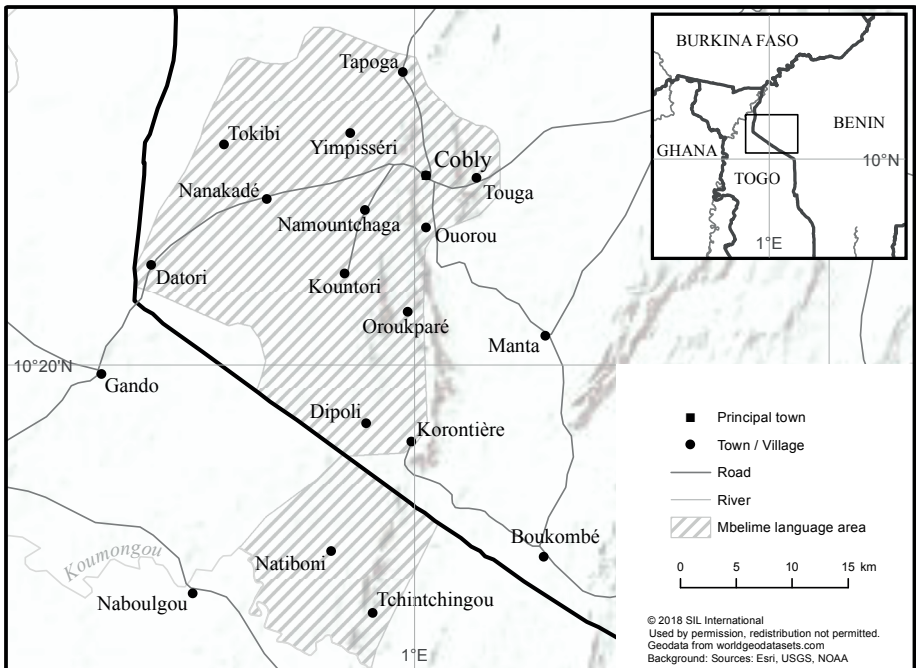


Figure 1. The Mbelime language area

1. ISO 639-3 mql. Glossonym: /m̄bērímè/ <m̄ bēdíme>. Ethnonym: sg. /ūbīérò/ <ū bīédò>; pl. /bēbērībè/ <bē bēdíbe>. The flap [r] in both the glossnym and the ethnonym, which Olson (2020, p. 2) considers to be retroflex, is in free variation with [l] and [d]. Neukom (2004, p. 1) reports all three forms as having M HHL tone patterns.

of Benin, as well as urban centers such as Natitingou, Parakou and Cotonou. A diaspora is also present in Nigeria and Togo. The term “Niendé” which appears in the early literature is considered derogatory.²

J. Merz (2017, p. 10) gives the number of Mbelime speakers as 72,000 for Benin and Togo. This figure is based on the 2013 Benin census (INSAE, 2015, p. 13), and estimations that 70% of the population of the Cobly commune and the Dipoli and Korontière *arrondissements* of Boukombé commune are Mbelime speakers (Tchegnon & Guidibi, 2006, pp. 15, 17), as well as information supplied by Gblem-Poidi & Kantchoa (2012, p. 259) for Togo. Figures for diaspora populations are notoriously difficult to obtain (Todegnon, 2011, p. 39). J. Merz (2017, p. 39) estimates that about 35,000 Mbelime speakers live in countries neighboring Benin, most notably Nigeria, while roughly another 24,000 Mbelime speakers live in Benin, but outside their home territories of the communes of Cobly and Boukombé. This leads to a rough estimate of 131,000 Mbelime speakers in West Africa in 2017.

Mbelime speakers identify eight distinct varieties of their language. Most of these are influenced by contact with other languages (Table 1).

Table 1. Mbelime dialects

| Dialect | Locality | Influence |
|----------|------------------------|---------------|
| Central | Kountori, Namountchaga | – |
| Cobly | Cobly | French, Dendi |
| Ouorou | Ouorou | Ditammari |
| Valley | Oroukparé | Ditammari |
| Southern | Dipoli, Korontière | Ditammari |
| Western | Nanakadé, Datori | Gangam |
| Northern | Tapoga | Gourmantche |
| Eastern | Touga | Kounteni |

Local opinions differ as to where the “purest” form of Mbelime is spoken, but Kountori seems a likely candidate. The southern dialect spoken in Dipoli and Korontière appears to be the most distinct (Hatfield & McHenry, 2011, p. 9). Some claim that the lack of mutual comprehension between speakers in different areas is due to tonal differences (Hatfield & McHenry, 2011, p. 6; Neukom, 2004, p. 1), but this has yet to be substantiated with evidence.

2. See J. Merz (2017, pp. 9–10) for an interesting note on the origins of the language name.

1.2 Orthography development

The first orthography was developed in 1978 and approved a year later by the government's *Sous-commission de Linguistique*. In 1981, they re-evaluated and wrote up an account of the orthography in a seminar (SLM, 1981). It marked no tone, and early experience showed that this strategy did not work well. Partly in response to this concern, SIL assigned researchers to undertake a sociolinguistic survey in 1998 (Hatfield & McHenry, 2011), and to study the phonology (Hammond & Hamilton, 1997; Rietkerk, 2000). The proposal that emerged from this research to mark tone fully was ratified locally by the *Commission Linguistique* in 1999³ and nationally in 2008 (CENALA, 2011).⁴ However, orthography issues remained a common problem in Mbelime literacy and literature development. Most writers maintained their own version of the spelling rules, which they mastered to varying degrees. At times spelling, including the marking of tone, so seriously affected legibility and comprehension that published materials had to be withdrawn. This is one reason why Mbelime literacy staff agreed to participate in our 2015 experiment. Following this, three Mbelime delegates took part in an SIL tone orthography workshop in Kara, Togo, in November 2016 (Olson, 2020) and in April 2017, a third orthography reform, which maintained full tone marking but changed how the tones were indicated, was ratified locally (CNLM, 2017).⁵ Following this, in September 2017, a supplementary decision was made regarding the spelling of contour tones (J. Merz et al., 2017, pp. 12–13). To this day, however, certain Mbelime writers refuse to mark tone at all and continue to use the 1981 orthography. Details of the 1999 and 2017 reforms will be explained in due course (p. 68). All Mbelime orthographic data in this book, including the experimental texts, are cited following the 1999 orthography, since this was still being used at the time of the experiment. Figure 2 shows a text written in that orthography to show the visual effect of full tone marking.⁶

Kē kōōke nne kē būōke yē dēē biití n nōōsí ā būōne ā fē. Dāāde bā ā ú bō a kē kōōke nne kē būōke ā yē : « Tí bōkí n yūutā nkaā ū tēwuchy hīnnī. » A be dēētā ū kūōhy n bōkí. Be tóító nēnnē a kē kōōke ā yē : « Mēñ' yē hētí maa n tōnni. Mēñ' yē niñ' fúdí n diē n tūōsí a hē ā ú bō ā tēēhē n basí n cōōnnine ū kūōhy hīnnī. »

Figure 2. Mbelime written with full tone marking (1999 orthography)

3. We have been unable to locate the report of this seminar, but the decisions made were applied in the pedagogical materials that followed (CLLM, 2003a, 2003b; S. Merz et al. 2005/2013; Sanhouégoua et al. 2016).

4. This institution was recently renamed as the Institut National de Linguistique Appliquée.

5. We have taken the liberty of correcting some tones after checking them with an L1 informant.

6. For the origin of this text and a free English translation, see p. 30, footnote 8.

1.3 Previous research

The first mention of Mbelime (or Niendé as it was known at the time) in the linguistic literature is a vocabulary list (Mercier, 1949), followed by a brief article exploring Mbelime's position within Oti-Volta (Manessy, 1976), and a response to it (Cornevin, 1978). The comparative approach has been picked up again more recently (C. Sambiéni, 2005, 2013). Detailed description consists of a grammar (Neukom, 2004), a summary of the noun class system (Reineke, 2012), and a syllable structure analysis (Melick, 2012a). As for the tone system – arguably the most complex of the ten focal languages in this study – it has recently undergone thorough autosegmental treatment, with two analyses of verbs (Melick, 2012b; Rietkerk, 2000) and one of nouns (Liu, 2013). As for the domain of lexicography, a thematic French-Mbelime lexicon contains about 750 words (N. Sambiéni et al. 2012), and an online bilingual Mbelime-French dictionary that is a work in progress currently contains over 4600 entries (Sambiéni et al., 2004–2019).

1.4 Typology

Mbelime has SVO word order and 15 noun classes (Neukom, 2004, p. 23),⁷ with a robust system of bilateral affixation. Suffixes are obligatory whereas prefixes are absent in some constructions. In seven of the classes, prefixes are segmentally identical to their corresponding suffixes while the others are phonologically similar (Reineke, 2012, p. 152). According to Neukom (2004, pp. 23, 54–55), the prefixes function as articles, but see Reineke (2012, p. 172) for a more nuanced perspective. Permissible syllable structures are CV, CVV, CVN, CVVN, V, and N though the latter two are restricted to only a few grammatical particles (Neukom, 2004, p. 10).

1.5 Consonants

Mbelime has 14 consonant phonemes. Table 2 presents the consonantal grapheme-phoneme correspondences in the 1999 orthography. The 1981 alphabet included the letters <d, l, r> to represent the allophones [d ~ l ~ r] respectively (Neukom, 2004, p. 6) but the 1999 spelling retained only <d> (S. Merz et al., 2005/2013, p. 6). The 2017 reform reintroduced <l, r> for borrowed words and proper names (CNLM, 2017, pp. 8–9; J. Merz et al., 2017, pp. 7–8).

7. According to Reineke (2012, p. 152) Mbelime has 16 nouns classes because she separates class 4 into two classes, but all other researchers concur with Neukom.

Table 2. Mbelime consonantal grapheme-phoneme correspondences in the 1999 orthography (based on Neukom, 2004, p. 5)

| | Labial | Apical | Palatal | Velar | Labio-velar | Glottal |
|-------------|--------|--------|---------|-------|---------------------|---------|
| Stop | p | t | c | k | \widehat{kp} <kp> | |
| | b | ɗ <d> | | | | |
| Fricative | f | s | | | | |
| Nasal | m | n | | | | |
| Approximant | | | y | | w | h |

The labio-velar stop / \widehat{kp} / <kp> has two allophones in free variation [\widehat{kp} ~ k^w] (Neukom, 2004, p. 6), but the spelling is invariable (S. Merz et al., 2005/2013, p. 7).

The sounds [ɲ, ɳ] were originally spelled <ny, ɳ>, but were eliminated in the 1999 reform when it was found they were allophones of the nasal phonemes /m, n/ respectively (Hammond & Hamilton, 1997, pp. 7–8, 18–19). The nasal /n/ is realized homorganically with the following consonant, e.g. [ɲf, nt, ɳɗ, ɲc, ɳk] (Neukom, 2004, p. 7), but is now written invariably <nb, nd, nk>. This is also true of the 1st person singular pronominal marker / \widehat{n} / < \widehat{n} > *I ~ me ~ my*, and the verbal marker / \widehat{n} / <n> even though in these cases the homorganicity occurs over an orthographic word boundary (S. Merz et al., 2005/2013, p. 7).

The consonants /b, d/ are sometimes realized as nasals before /m, n/, creating geminate nasals (Neukom, 2004, pp. 11–12). The orthography writes the deep form. In such cases, the first nasal is tone bearing, whereas the second is not (1).

- (1) a. /bē bòṁ-bè/ → [bē bòṁmè] <bē bōmbē> *the sick people*
 b. / \widehat{n} dú/ → [\widehat{n} nú] < \widehat{n} dú> *I want*

Neukom (2004, p. 11) finds limited evidence of geminate consonants in words with the syllable structure CVC.CV. Liu's (2013) database confirms this, as it contains 21 geminate structures out of a total of 689 nouns. However, Melick (2012a, p. 6; 2012b, pp. 49–51, 62–65) claims that most verbs are CVC.CV and only a limited number are CV.CV. Example (2) shows the contrast between C and CC which is currently under-represented and not mentioned in the spelling reform documents or the orthography guide.⁸

- (2) a. /biddi/ <bīdi> *to urinate*
 b. /bidí/ <bidí> *to accept*

8. Melick (p. c.) considers the consonantal length contrast to be subtle but probably measurable. She admits that it may not be a relevant issue for orthography development, since its functional load is very light.

1.6 Vowels

Mbelime has seven basic vowel phonemes. Table 3 presents the vocalic grapheme-phoneme correspondences in the 1999 orthography.⁹

Table 3. Mbelime vocalic grapheme-phoneme correspondences in the 1999 orthography (based on Neukom, 2004, p. 7)

| | Oral | | | Nasal | | |
|-----------|-----------|---------|---------|-----------|---------|---------|
| | Unrounded | | Rounded | Unrounded | | Rounded |
| | Front | Central | Back | Front | Central | Back |
| Close | i | | u | ĩ <ɨ> | | ũ <ɥ> |
| Mid-close | e | | o | | | |
| Mid-open | ɛ | | ɔ | ẽ <ɛ̃> | | õ <ɔ̃> |
| Open | | a | | | ã <ã> | |

All vowel graphemes are written with their IPA equivalents. Long vowels are written by doubling the vowel (S. Merz et al., 2005/2013, p. 3). Five of the seven vowels can be nasalized. Nasalization was originally written with a superscript tilde <̃> in line with the Beninese government's recommendations for northern languages at that time. However, since the 1999 reform it has been written with a subscript tilde <̣> to leave room for marking tone, a convention which is deliberately borrowed from the neighboring language Nateni. Nasalization is marked only on the first mora of a long vowel (S. Merz et al., 2005/2013, p. 4).

Mbelime has five diphthongs: /ie, ie, ua, uo, uɔ/. Again, when they are nasalized, the tilde is marked only on the first vowel <iẹ, iẹ, uạ, uọ, uɔ̣> (S. Merz et al., 2005/2013, p. 4). Since vowels following nasal consonants are always realized as nasal, they are not written with a tilde (3; S. Merz et al., 2005/2013, p. 5; Neukom, 2004, p. 5).

(3) /dĩ nããdè/ <dĩ naade> *millstone*

Neukom (2004, p. 8) draws attention to a tendency whereby vowels may be realized as nasal following a word medial /h/. In this context the tilde is written because the process is not entirely predictable (4; S. Merz et al., 2005/2013, pp. 4–5).

(4) /ã tēēhè/ <ã tēēhɛ̣> *land*

Vowels undergo several phonological processes (Neukom, 2004, pp. 12–16).

- *Reduction*: A word-final vowel may reduce to /i/ when it is followed by another word. The orthography advises maintaining a consistent word image but tolerates both spellings (5; S. Merz et al., 2005/2013, p. 10).

9. These conventions remain the same in the 2017 orthography.

(5) /bāntā hé-sí/ → [bāntí hégí] <bāntā hégí ~ bāntí hégí> *in ten years*

- *Assimilation*: In vowel sequences where V_2 is a round vowel, this feature spreads left onto V_1 (6a). The same process sometimes happens in VCV sequences, if V_1 is /i/ (6b). In addition, the vowel of the prefix may assimilate to that of the noun root (6c), and that of the subject pronoun to that of the verb root (6d). The orthography represents the deep form.

(6) a. /nnè ū cīèbù/ → [nnò ū cīèbù] <nne ū cīebu> *with soap*
 b. /tūkītā/ → [tūkūtā] <tūkītā> *to continue*
 c. /tī hēètè/ → [tē hēètè] <tī heete> *shame*
 d. /tī hósíkí/ → [tū hósíkí] <tī hósíkí> *we become many*

- *Elision*: When the final syllable of a word begins with a nasal, the vowel elides, leaving the nasal as the tone bearing unit. The elision is not usually marked in the orthography¹⁰ (7a). In certain specific grammatical contexts, when a syllable begins with a vowel, the preceding vowel (with its tone) elides (7b). Spelling tends to be shallow but the representation of example (7a) is deep because of the lack of <ŋ> in the alphabet.

(7) a. /ù bōmù wē/ → [ù bōŋ wē] <u bōmu wē> *he/she is sick*
 b. /ñ dí ā dó/ → [ñ dā dó] <ñ dā dó> *I will give you*

Neukom (2004, p. 16) refers to a fourth process of vowel insertion that would merit further study.

1.7 Word boundaries

The 1999 orthography writes noun class prefixes separately from the following noun except in the case of proper nouns (S. Merz et al., 2005/2013, pp. 11–12). The 2017 orthography reform opted to join them to the following noun in order to distinguish them from their corresponding possessive pronouns (8; based on J. Merz et al., 2017, p. 16).

(8) a. /ünōḥù/ <ünōḥu> *the shoe*
 /ū nōḥù/ <ū nōḥu> *his/her shoe*
 b. /bēbīyāpè/ <bēbīyāpε> *the sons*
 /bē biyāpè/ <bē biyāpε> *their sons*

10. Exceptions concern the elision of noun class suffixes in possessive constructions where both possessor and possessed are nouns (e.g. < ū wien' būke > *god's child*) and when a noun is followed by an adjective (e.g. < Tihún' saate. > *The sauce is good.*) (Sharon Merz et al., 2005/2013: 14–15). A second exception concerns temporal and modal adverbs (e.g. < fúnne >, < fún' > *now*) (S. Merz et al., 2005/2013: 13–14; J. Merz et al., 2017: 24–25). In both cases the missing syllable or vowel is replaced by an apostrophe.

1.8 Tone

1.8.1 Generalities

Mbelime has three discrete level tones (H, M, L), downstep, upstep, and various other tonal processes. Neukom (2004, p. 18) considers the phonological TBU to be the mora (i.e. V and pre-consonantal N). Melick concurs with this in one paper (2012a, p. 6), but in another analyzes the phonological TBU as being the syllable, while invoking certain moraic association constraints (2012b, pp. 90–104). Noun class prefixes and suffixes carry intrinsic tones: all the prefixes carry M tone; all the suffixes carry either H or L tone (Neukom, 2004, p. 24). Melick (2012b, pp. 67–68) asserts that verbs have underlying H, M, or L lexical tone, and that the aspectual suffixes each have their own tones, which interact with the verb's lexical tone to produce the surface patterns. As she notes, this is uncontroversial in itself, yet represents the most significant departure from Rietkerk (2000) and Neukom (2004), who both analyze verbs as having classes distinguished by replacive grammatical tonal inflection and no identifiable lexical tone.

The most important change in the 1999 orthography reform was the decision to mark tone fully, i.e. on all vowels and on all pre-consonantal, final and isolated nasals, following the recommendation of Hammond & Hamilton (1997, p. 28), with the exception of proper names and borrowed words. The unusual decision to mark H tone with the acute accent <◌́>, M tone with a macron <◌̄>, and L tone by absence of a diacritic <◌> meant that Mbelime had a tone marking system that was unique in Benin (CENALA, 2011, pp. 30–31). However, in April 2017, following the experiment and a subsequent orthography workshop (Olson, 2020), orthography stakeholders in the Mbelime community made the decision to mark L tone with a grave accent and leave M tone unmarked (CNLM, 2017, p. 9), bringing Mbelime into alignment with all other Beninese three-tone languages. Furthermore, tone is now marked on proper names and borrowed words (CNLM, 2017, p. 10).

The following sections summarize the major tonal processes and how they are represented orthographically: downstep (Section 1.8.2), upstep (Section 1.8.3), contour tones (Section 1.8.4), M tone insertion (Section 1.8.5), L tone spread (Section 1.8.6), and H tone spread (Section 1.8.7). We conclude by cataloguing existing knowledge of lexical tone (Section 1.8.8) and grammatical tone (Section 1.8.9).

1.8.2 Downstep

Mbelime has automatic downstep – Neukom (2004, pp. 18–19) calls it *downdrift* – in which a H following a M or L is realized lower than the preceding H, and a M following a L is realized lower than the preceding M. Downstepped H may be realized at the same or lower pitch than the preceding M (Liu, 2013, p. 8; Melick, 2012b, pp. 71–72).

Neukom (2004, pp. 17–19) cites several examples of what he considers to be non-automatic downstep. In Example (9), the second person singular subject pronoun merges with the conditional morpheme, leaving a floating M that causes non-automatic downstep on the following H-tone negative morpheme. The putative downstepped H of the negative morpheme [‘há] in Example (9) is written as M <há> apparently because it is preceded and followed by M tones.¹¹

- (9) /á ā hǎ kūdǒǒ/ → [á ‘hǎ kūdǒǒ] <á ā hē kūdǒǒ>
 CND SP2SG NEG shave-PER
If you do not shave...

However, in a H frame this morpheme is also pronounced M (e.g. /sī bíísí hǎ tóntò/ <sī bíísí hē tóntò> *the children have not arrived*) and we have been unable to find any instances where the negative morpheme is written with a H tone, suggesting that Neukom’s transcription may be erroneous. Example (10) is more convincing. Here, the conditional morpheme /á/ merges with the third person singular subject pronoun /ù/, leaving a floating L that causes non-automatic downstep on the following H-tone morpheme /dú/ (based on Neukom, 2004, p. 19).

- (10) /á ù dú ò dí tóntá/ → [á ‘dú ò dí tóntá]
 CND SP3SG want CNJ FUT come-NEU
 <á ù dú ò dí tóntá> *If he/she wants to come...*

The 1999 orthography represents downstep in its surface form (Olson, 2020, p. 8). When the pitch of a downstepped H tone is close to or the same as that of an adjacent M tone (e.g. a H suffix following a M root), it is written with a macron rather than an acute accent (11).¹²

- (11) a. /sī-būǒ-sí/ → [sī-būǒ-‘sí] <sīb ūǒsī> *dogs*
 b. /sī-sūǒ-sí/ → [sī-sūǒ-‘sí] <sīs ūǒsī> *flies (n.)*

Similarly, when the pitch of a downstepped M tone is close to or the same as that of an adjacent L tone, it is written with absence of an accent rather than with a macron.¹³ Orthography stakeholders are strongly resistant to writing it in any other way (12; based on Rietkerk, 2000, pp. 146–147).

- (12) /kē` sī/ → [kē ‘sī] <kēsi> *understand\NEU*

11. In example 9, the standard spelling of /hǎ/ as <hē> is due to dialect variation (J. Merz et al., 2017, p. 23) and is often disputed. The same comment applies to Example (9).

12. If describing the 2017 orthography this statement would read “...it is written with absence of an accent rather than an acute accent”.

13. If describing the 2017 orthography this statement would read “...it is written with a grave accent rather than absence of an accent”.

1.8.3 *Upstep*

Previous researchers all concur with the existence of an iterative process that Melick (2012b, pp. 67, 82–84) refers to as “terracing upstep of consecutive Hs” in which a H following a H is raised.¹⁴ This process is not marked in the orthography (13; based on Neukom, 2004, p. 20).¹⁵

- (13) /dḗ n̄ dḗm̄m̄ mù mà dḗ n̄ bá'dím̄/
- [dḗ n̄ †dém̄†m̄ mù mà dḗ n̄ †bá†dí†m̄]
- <dḗ n̄ dḗm̄m̄ maa dḗ n̄ bá'dím̄ !>
- Don't lie or deceive!*

See Melick (2012b, p. 69) for examples of how upstep applies when two H tones coincide on a single syllable.

1.8.4 *Contour tones*

Mbelime contour tones have only been identified relatively recently (Melick, 2012b), and they were overlooked in all three key stages of orthography development: in 1981, 1999, and April 2017. They are not mentioned in the pedagogical materials (CLLM, 2003a, 2003b; Sanhouégoua et al., 2016), and they are not formally taught in the literacy classes. The decision to under-represent them by only writing the outermost tones of the word level tone pattern was made following discussions between orthography stakeholders in September 2017. The newly revised orthography guide (J. Merz et al., 2017, p. 12) is the first local publication to mention them (14).¹⁶

14. To account for Mbelime, Melick (2012b, p. 82) prefers absolute register features (Yip, 2002) to the relative register features of Register Tier Theory (Snider, 1999) because upstep does not affect the register of subsequent L tones. A Register Tier approach would also require downstep of H and M to be analyzed as two separate processes, as well as unnecessarily complex explanations for the behavior of L tones.

15. The lack of upstep on the second mora of the word [†dém̄†m̄] *to tell a lie* (rather than [†dé†m̄†m̄]) suggests that the phonological TBU is the syllable. However, Melick (p. c.) points out that Mbelime does not favor a straightforward syllable or mora analysis because different pieces of evidence support either possibility. She even questions whether the field of tone studies needs to allow for more nuanced approach to the definition of the phonological TBU to take languages like Mbelime into account.

16. Although these examples are from the 2017 orthography guide, the orthographic data is transcribed with the 1999 tone marking conventions since these were still being used at the time of the experiment reported in this book (i.e. M tone with a macron, L tone with absence of an accent).

- (14) a. L.M̂L /dùà/ <duā> *end*\PER
 b. M.M̂L /kiē/ <kīe> *heal*\PER
 c. M̂L.M /hōnē/ <honē> *yesterday*
 d. M̂L.L /hēdi/ <hēdi> *until, during, since*
 e. M.M̂H.L /bēhǒpè/ <bēhǒpe> *witches, sorcerers*

The literacy workers who prepared the four texts for our experiment (in 2014) marked contour tones following their instincts. Three years later (in 2017), decision makers validated their spelling, which means that retrospectively, their way of marking contour tones was almost 100% accurate.

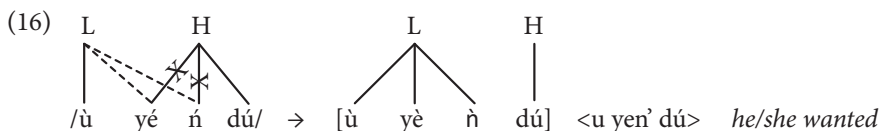
1.8.5 M insertion

In certain contexts, a M tone occurs on the first syllable of a root that would otherwise carry a L tone. This occurs on verbs with L tone roots in the imperfective and neutral aspects, apparently regardless of the preceding tone pattern (15a, 15b) and with compound nouns in which the first noun root bears a L tone (15c). The motivation for the M insertion remains unclear (Melick, 2012b, pp. 72–74; Olson, 2020, p. 6).

- (15) a. /m̂ bàñ-tò/ → [m̂ bàñ-tò] <m̂ bàñ-tò> *I waited*
 b. /ù cǒǒ-tà/ → [ù cǒǒ-tà] <u cǒǒ-ta> *Let him/her vaccinate!*
 c. /fē nàà-fè/ + /dī cùùdè/ → [dī nàà-cùù-dè] <dī nāa-cuu-de> *cattle shed*
 (lit. cow + hut)

1.8.6 L tone spread

Any L followed by a sequence of two Hs spreads rightwards (Liu, 2013, pp. 18–19; Melick, 2012b, pp. 88–89, 92), as Example (16) illustrates (Neukom, 2004, pp. 20–21). Further analysis is required to ascertain in which other grammatical constructions this occurs.

- (16) 

Example (17) illustrates that the spelling of this process is variable between surface and underlying forms.

- (17) a. /ù hébitá/ → [ù hèbitá] <u hebitá> *May he/she slit (throat)!*
 b. /ñ hón pún̂n̂/ → [ñ hón pún̂n̂] <ñ hón pún̂n̂> *I grilled yesterday*

For other examples, see Melick (2012b, p. 88) for the verb phrase and Liu (2013, p. 19) for the noun phrase.

In Example (18), the underlying form contains only a single H, but the spreading still takes place, resulting in a LH contour (Neukom, 2004, pp. 20–21) The contour is not represented in the orthography.¹⁷

(18) /ù hítò/ → [ù hítò] <u hítò> *he/she left*

In Example (19), L tone spreading also spreads onto a word that begins with a M tone (Neukom, 2004, pp. 20–21). In this example, the spelling is faithful to the underlying form.¹⁸

(19) /ù yōōtò/ → [ù yōōtò] <ù yōōtò> *he/she spoke*

1.8.7 H tone spread

Neukom (2004, p. 22) lists four H-tone grammatical particles which sometimes spread right onto a following M tone syllable: the hodiernal past /mín/ (20a), the future /dí/ (20b), the habitual /tá/ (20c), and the durative /ń/ (20d).¹⁹ Once H tone spreading has occurred, upstep of successive H tones applies as usual. The orthography is deep for all these forms.

- (20) a. /ñ mín bānā/¹⁹ → [ñ mín †bānā] <ñ mín' bānā> *I was waiting (earlier today)*
 b. /ñ dí yōntā/ → [ñ dí †yōntā] <ñ dí yōntā> *I will sing*
 c. /ā tá sēntā/ → [ā tá †sēntā] <ā tá sēntā> *when you (habitually) wake up*
 d. /ñ dí ń yōmmù/ → [ñ dí †ń †yōmmù] <ñ dí ń yōmmu> *I will eat (habitually)*

17. Melick (2012b, pp. 88–89) analyses similar forms as having a H-†H contour rather than a L-H contour. A number of the transcriptions in her database do not match Neukom's.

18. Melick (p. c.) never found L tone spreading onto a M tone word, and some of the words that Neukom identifies as M, Melick considers to be L.

19. Neukom (2004, p. 22) lists the hodiernal past /mín/ as undergoing this process, but our informant does not pronounce such forms with H tone spreading.

20. Melick (p. c.) has [bàntò] *wait* in her database.

1.8.8 Lexical tone

The published literature lists numerous lexical tonal minimal pairs among nouns (e.g. 21).

- (21) a. /kē wáń-kè/ <kē wáńkε> *calabash* (Neukom, 2004, p. 17)
 /kē wāñ-kè/ <kē wāñkε> *animal*
 b. /dī bòn-dè/ <dī bonde> *boundary* (S. Merz et al., 2005/2013, p. 9)
 /dī bóń-dè/ <dī bóńde> *river*

Numerous lexical tonal minimal pairs and triplets are also found among verbs (e.g. 22).

- (22) a. /hūóní/ <hūóní> *dry*\NEU (Neukom, 2004, p. 107)
 /hūónī/ <hūónī> *scold*\NEU
 b. /báńtò/ <báńtò> *deceive*\PER (Neukom, 2004, p. 17)
 /bāńtò/ <bāńtò> *recognize*\PER
 /bàńtò/ <bantò> *invite*\PER

A single inventory of pronominal markers serves subject and object functions (Neukom, 2004, pp. 84–87). Grammatically, their syntactic positions set them apart from each other, but lexically, two sets of tonal minimal pairs are found among them (23).

- (23)
- | | SBJ | OBJ |
|----|-----------------------------------|--------------------------|
| a. | /dī/ <dī> <i>you (pl)</i> | <i>you (pl)</i> |
| | /dì/ <dì> <i>he, she, it (C3)</i> | <i>him, her, it (C3)</i> |
| b. | /tī/ <tī> <i>we</i> | <i>us</i> |
| | /tì/ <tì> <i>they (C10)</i> | <i>them (C10)</i> |

1.8.9 Grammatical tone

Mbelime has three major TAM verb forms – neutral,²¹ perfective, and imperfective – that are usually distinguished both segmentally and tonally (Neukom, 2004, p. 96). However, grammatical tonal minimal pairs are not uncommon, especially between the neutral and imperfective.²² Neukom (2004, pp. 104–105, 112, 114) cites 58 cases (see examples in Table 4).

21. The neutral aspect is the citation form and has consecutive and imperative functions (Neukom, 2004, pp. 123–126). It is also used to form the future.

22. Our verification of Neukom's examples with an L1 informant makes us question whether he sometimes confuses imperfective and habitual forms.

Table 4. Tonal minimal pairs in the neutral and imperfective

| NEU | | IPF | | |
|----------|----------|----------|----------|-------------------|
| /kēˈsī/ | <kēsi> | /kēsí/ | <kēsí> | <i>understand</i> |
| /dāmpù/ | <dānpu> | /dāmpú/ | <dānpú> | <i>touch</i> |
| /bīiti/ | <bīiti> | /bīítí/ | <bīítí> | <i>plaster</i> |
| /hūòdì/ | <hūodi> | /hūòdī/ | <hūodī> | <i>farm</i> |
| /císímù/ | <císimu> | /císímú/ | <císímú> | <i>sneeze</i> |

Neukom (2004, pp. 96, 112–114) also cites nine examples of grammatical tonal minimal pairs between the neutral and perfective (e.g. Table 5).

Table 5. Tonal minimal pairs in the neutral and perfective

| NEU | | IPF | | |
|-------|-------|-------|-------|---------------------|
| /dēē/ | <dēē> | /dēè/ | <dēè> | <i>eat</i> |
| /póó/ | <póó> | /póò/ | <póò> | <i>kill</i> |
| /yéé/ | <yéé> | /yéè/ | <yéè> | <i>draw (water)</i> |
| /kīē/ | <kīē> | /kīè/ | <kīè> | <i>heal</i> |
| /dīē/ | <dīē> | /dīè/ | <dīè> | <i>go up</i> |
| /díí/ | <díí> | /díì/ | <díì> | <i>extinguish</i> |

In addition, Neukom (2004, pp. 110–112, 114) lists 19 examples of grammatical tonal minimal pairs between the perfective and the imperfective (e.g. Table 6).

Table 6. Tonal minimal pairs in the perfective and imperfective

| PER | | IPF | | |
|---------|---------|---------|---------|-------------------------|
| /tóò/ | <tóo> | /tōō/ | <tōō> | <i>carry</i> |
| /tépò/ | <tépo> | /tēpò/ | <tēpo> | <i>push</i> |
| /tòdɔ̀/ | <todɔ> | /tōdɔ̀/ | <tōdɔ> | <i>make the most of</i> |
| /cááhò/ | <cáahɔ> | /cāáhò/ | <cāahɔ> | <i>prevent</i> |
| /dūòsò/ | <dūosɔ> | /dūòsò/ | <dūosɔ> | <i>drown</i> |
| /dūònò/ | <dūonɔ> | /dūònò/ | <dūonɔ> | <i>give</i> |

Neukom (2004, pp. 113, 116) cites six examples of tonal minimal triplets and homophones in the neutral, perfective, and imperfective (e.g. Table 7).

Table 7. Tonal minimal triplets and homophones in the neutral, perfective, and imperfective

| NEU | | PER | | IPF | | |
|-----------|-----------|-----------|-----------|-----------|-----------|-----------------------|
| /siē/ | <siē> | /siè/ | <siè> | /siè/ | <siè> | <i>play (trumpet)</i> |
| /kósínè/ | <kósíne> | /kósínè/ | <kósíne> | /kósínè/ | <kósíne> | <i>return</i> |
| /mííkinè/ | <mííkíne> | /mííkinè/ | <mííkíne> | /mííkinè/ | <mííkíne> | <i>twist</i> |

Some verbs have a fourth habitual form. Most of these have a distinctive segmental suffix, but Neukom (2004, p. 120) cites one example of a grammatical tonal minimal pair between the perfective and habitual (Table 8).

Table 8. Tonal minimal pairs in the perfective and habitual

| PER | | HAB | | |
|---------|---------|---------|---------|-----------------|
| /wáànǎ/ | <wáanǎ> | /wáànǎ/ | <wáanǎ> | <i>look for</i> |

Finally, a small group of verbs have a /-nè/ causative extension; in such cases the basic three-way aspectual distinction is marked only by tonal inflection (24; Melick, 2012b, pp. 65–66).²³

- (24) a. /ñ yáásīnè/ <ñ yáásīne> *I introduced*\PRF
 /ñ yáásīnè/ <ñ yáásīne> *I am introducing*\IPF
 /ñ yáá⁴sīnè/ <ñ yáásīne> *I introduce*\NEU
 b. /m píékīnè/ <ñ piékīne> *I whitened*\PRF
 /m piékīnè/ <ñ piékīne> *I am whitening*\IPF
 /m piékīnè/ <ñ piékīne> *I whiten*\NEU
 c. /m sǒòkīnè/ <ñ sǒókīne> *I darkened*\PRF
 /m sǒòkīnè/ <ñ sǒókīne> *I am darkening*\IPF
 /m sǒòkīnè/ <ñ sǒókīne> *I darken*\NEU

Tense and modal nuances are articulated by means of additional preverbal particles that are written as separate orthographic words. Of the 26 that Neukom (2004, pp. 129–159) presents, three form a tonal minimal triplet (25a) and two more a tonal minimal pair (25b).

- (25) a. /mín/ <mín> *hodiernal past* (pp. 129, 131–133)
 /mín/ <mín> *has/have just* (p. 152)
 /mīñ/ <mīñ> *not yet* (pp. 152–153)
 b. /nín/ <nín> *future* (pp. 129, 137–140)
 /nīñ/ <nīñ> *then*²³ (p. 154)

Neukom's (2004) analysis also contains the following examples of other grammatical particles that would be ambiguous if tone were not marked orthographically (26).

23. Example (24) contains our interpretation of Melick's phonetic transcriptions, verified with the author. Melick (p. c.) admits that the exact tones patterns are as yet unclear, in particular with respect to whether the apparently downstepped tones are M or H since both can be downstepped, which is why the phonemic and orthographic data are sometimes divergent.

24. Neukom (2004, p. 154), writing in French, glosses this item as "alors" and admits that the exact meaning requires further study.

- (26) a. /á/ <á> *if, or (pp. 172, 222–223)*
 /ā/ <ā> *proper name object marker (p. 168)*
 /ã/ <ã> *topicaliser (p. 200)*
 /à/ <a> *and (pp. 172, 219–222)*
 b. /hīnnī/ <hīnnī> *in (pp. 169–171)*
 /hínní/ <hínní> *on (pp. 169–171)*
 c. /bá/ <bá> *reflexive (p. 180)*
 /bā/ <bā> *what? (pp. 187, 191–192)*

Lastly, focus can be marked by a M tone on the last syllable of a noun (27; based on J. Merz et al., 2017, p. 14).

- (27) /ū tūùtìbù, ū tūùtìbū/ <Ū tūutibu, ū tūutibū.> *Theft is theft.*
 /ù bōkò kē dāākè/ <U bōkò kē dāākè.> *He/she went to the market.*
 /ù bōkò kē dāākē/ <U bōkò kē dāākē.> *He/she went to this particular market.*

For further analysis of the level of written ambiguity in Mbelime see Olson (2020). For a comparative analysis of written ambiguity in Mbelime, Elip, and Eastern Dan see Roberts et al. (2020).

2. Literacy background

2.1 Literacy programs

The *Sous-commission de Linguistique* launched the first Mbelime literacy campaign in 1978. A survey twenty years later reported 42 literacy centers in what is now the commune of Cobly, six of which were church-based, ten in what is now the commune of Boukombé, and others (unnumbered) in the Borgou department (Hatfield & McHenry, 2011, p. 8). These days, the main provider of L1 literacy is the *Association des Alphabétisateurs en Langues de Cobly (AALC)*, which was founded in 2007. Another association called *Bikibanki: Association des Alphabétisateurs en Langue Mbèlimè (Dipoli et Korontière)* started two years before AALC, but took longer to get established. Both associations now run an annual campaign in the Cobly and Boukombé communes and, more recently, in the Borgou department. Table 9 shows the enrolment figures for the seven years prior to the experiment.²⁵

25. Figures for the years before 2009 are unobtainable.

Table 9. Enrolments in the Mbelime literacy programs

| | AALC | | | Bikibanki |
|--------------|-------------|-------------|------------|--------------|
| | Level 1 | Level 2 | Level 3 | Levels 1 & 2 |
| 2009 | 523 | 234 | – | – |
| 2010 | 404 | 161 | – | – |
| 2011 | 185 | 163 | – | – |
| 2012 | 267 | 174 | 79 | – |
| 2013 | 165 | 140 | 295 | – |
| 2014 | 79 | 66 | 116 | 182 |
| 2015 | 256 | 104 | 104 | 118 |
| Total | 1879 | 1042 | 594 | 300 |

In the past, some NGOs have organized their own campaigns, but more recently they have been working through AALC, mainly by supporting them financially. The *Commission Nationale Linguistique Mbèlimè (CNLM)* was revived in 2015 after many dormant years and, in 2016, started to offer some literacy-related events mainly targeting those who have already learned French, the official language of Benin, in school. A private school in Cobly, *Le Réveil*, started a program in 2015 to teach children Mbelime as a subject starting in fourth grade (that is, after three years of French). By 2017, however, this initiative had already been abandoned for reasons that remain unclear.

2.2 Literature production


Literature production began in earnest at the turn of the millennium, and a modest range of literacy materials is now available. In addition to the orthography guides already cited above, publications include booklets on: simple math; women's rights; health issues such as water hygiene, malaria, alcoholism, and ebola; agricultural issues such as soy bean production and the importance of the locust bean tree; as well as promotion of crafts and trades. To this list can be added an alphabet chart, calendars, short stories, folktales, proverbs, and riddles produced at multilingual writers' workshops; the Gospel of Luke; and, most recently, a book presenting the 23 Mbelime speaking communities.

2.3 Pedagogical materials

2.3.1 *Primer*

In the Mbelime two-volume primer series (CLLM, 2003a, 2003b),²⁶ tone is the first element taught, with four pages of tonal minimal pairs. On these pages, each word is followed by a box where learners are expected to pick out the one that matches the picture, and then, after both words have been introduced, by a 3x3 table containing the two words in random order. The remaining lessons follow the Gudschinsky method (Lee, 1982), with every fifth lesson being a review. Tones are not written in drill boxes (Figure 3).

dī bēñtīde 21 y Y



dī yūude
yūude
yūu

1

| | | | |
|----|----|----|----|
| u | ɔ | ɛ | i |
| yu | yɔ | yɛ | yi |

2

| |
|----|
| yu |
| yɔ |
| yɛ |
| ya |

3

| | | | |
|----|----|----|----|
| yu | yɔ | yɛ | yi |
| su | sɔ | sɛ | si |
| bu | bɔ | bɛ | bi |

yūo si
yūosi

m̄ yē n dɔ m mɛ
m̄ yendɔmmɛ

yē kī tā
yēkītā

dī yūu de
dī yūude

m̄ yīē dī mɛ
m̄ yīēdīmɛ

dūo mɔ
dūomɔ

16

Figure 3. Mbelime Gudschinsky drill (CLLM, 2003b, p. 16)

²⁶ There is an accompanying teachers' guide (CLLM, 2000). The current primers were preceded by another series (Anonymous, 1985a, 1985b, 1985c) which are the earliest known publications in Mbelime.

The primer series was intended to be taught over a period of three to four months with classes meeting for an hour or so three times a week. However, discussions with Mbelime literacy coordinators and supervisors in July 2013 revealed that, other than beginning with tone, the Mbelime literacy classes are not using the primer as intended. Essentially, they are following the Freire-based method (Freire, 1970) used by the Beninese government, where the vowels are taught first, then the consonants, and then they go back and “teach” the primer. At the end of each of these lessons, the teacher reviews the tone patterns, but does not connect them to the words used in the story.


This portion of the teaching program is considered to be a sort of pre-primer (Bernard Sanhouégoua, p. c.). Advantages of this approach include the separation of tones from letters and matching of hummed tone patterns with markings. However, it is an inappropriate use of the primer as it is designed. After the 2–4 weeks (depending on the frequency of their meetings) each class takes to learn the tone marks for the three basic tones H, M, and L, plus the vowels and consonants, they go through both volumes of the primer in year one. In year two, they teach the other tone patterns and then re-teach both volumes of the primer, adding additional reading material.

During the first lesson, they focus on the level tones, rather than combinations. The teacher uses real objects and actions to elicit words that are tonal minimal pairs. The teacher writes the words on the board without tone marks, makes sure that everyone hears the difference as these words are pronounced, then asks how learners would differentiate the words in writing. Learners then hum the three tones as the teacher points them out on the board. Next, for the different words they “read” the word (repeating after the teacher) and practice writing the tone marks. In later lessons, the “long tone”²⁷ (i.e. vowel length) is introduced and, where the tone does not change, the accompanying lengthening of the tone. The same procedure is used for the teaching of “long tones” as for “short tones” (Figure 4).

At the beginning of the second year of classes, teachers tackle combinations that seem to be a problem. They start with “heavy” (VV) monosyllabic words, and then proceed to words with three vowels (CVVCV), which are extremely common in Mbelime. During class, teachers write a pattern, hum it, and learners repeat it. Then teachers add the tone marking over the vowels, again learners pronounce it, and finally they add the consonant(s) that make(s) it a word.


27. This is an English translation of the French terminology the literacy supervisors used when they were demonstrating the method to JeDene Reeder in July 2013.

dī bēñtīde 1 tī néte



ā tāāde

| | | |
|---------|---------|---------|
| ā tāāde | ā tááde | ā tāāde |
|---------|---------|---------|



ā tááde

| | | |
|---------|---------|---------|
| ā tááde | ā tāāde | ā tááde |
|---------|---------|---------|

| | | |
|---------|---------|---------|
| ā tááde | ā tááde | ā tāāde |
| ā tāāde | ā tááde | ā tāāde |
| ā tááde | ā tāāde | ā tááde |

6

Figure 4. Mbelime tone awareness drill (CLLM, 2003a, p. 6)

Learners receive ample practice with these patterns in the primer, but the lack of availability of the teachers' guide²⁸ may result in less than adequate classroom practice. Another weakness is a lack of written tone drills on the primer drill pages. However, the lack of any grammar drills to raise awareness of grammatical features that trigger tonal processes as recommended by Kutsch Lojenga (2014, p. 67) and Wiesemann (1995, p. 30), is probably the most significant weakness of the primers.

2.3.2 Transition guide

The Mbelime transition guide (Sanhouégoua et al., 2016) for French literates desiring to learn to read their mother tongue can be used for a class situation or for independent study, as instructions are explicit and the answers to exercises are found in the back of the book. Although tones are used in examples in the very first

28. A teachers' guide (CLLM, 2000) exists but has never been widely circulated.

In the second tone lesson, the writing of tone marks is the focus. The learner is immediately informed that tone is written as it sounds in isolation not as it sounds in context, with the explanation that this preserves the visual form of the word, a key issue in fluent reading development (Adams, 1990, p. 410). Again, two exercises are presented. In the first, a list of individual words without tone marks, but with their glosses, is given. Learners are asked to read each word aloud to match the meaning of the French gloss, rewrite the word with the correct tone marks, and reread the word. In the second exercise, a short, two-sentence paragraph without tone marks is presented and students are asked to rewrite it with the correct tone marks, making sure that the meaning matches the given French translation. This exercise does include a grammatical tonal minimal pair.

Reading exercises for subsequent lessons teaching vowels continue to encourage the learners to pay attention to the tone marks when reading words or phrases aloud. However, this reminder is dropped for the consonant lessons, and only taken up again in lessons on grammatical tone. Learners are asked, on the other hand, to pay attention to the tone as well as the new letter in all the subsequent writing exercises so that both are written correctly (Figure 6).

Exercice 3:

a. Traduisez en mbèlimè les phrases ci-après sans oublier les marques de ton.

b. Lisez la phrase en mbèlimè.

c. Ecoutez-la !

1. *Ils sont fiancés.* _____
2. *Il tient le couteau.* _____
3. *Pousse-toi vers lui !* _____
4. *Tu as trop grossi.* _____
5. *Lave ton enfant !* _____
6. *Jouons de la flûte !* _____
7. *On doit planter les arbres.* _____

Figure 6. Writing exercise for the letters <s> and <c> in the Mbelime transition guide (Sanhouégoua et al., 2016, p. 35)

This transition guide's main strength is its frequent reminders to learners to pay attention to the tone marks, both in reading and in writing. Given the mobility of the Mbelime tone system, its explicit statement that tone is written on words as they are pronounced in isolation is another strength. This transition guide could be improved by more use of tonal minimal pairs when tones are being taught, and by use of drawings as a support for those who are weaker in French.

outsiders. Dan is spoken by about 1,600,000 people in all three countries (Vydrin, 2016), of whom it is estimated that 650,000 are Eastern Dan speakers (Eberhard et al. 2020), making it the second largest population among the focal languages, after Yoruba. Educated Ivorian Dan speakers are bilingual in French (the official language of Côte d'Ivoire). Many Ivorian Dan speakers are also proficient in interethnic Jula. Dan people also have language contact with Kpelle and neighboring Kru languages such as Gere and Wobe.

1.2 Orthography development

Before 1970,² Protestant missionaries of the *Mission Biblique* were using an orthography imported from Liberia. However, with little or no training in linguistics, vowels were under-represented and tone completely disregarded. The ability to read was apparently a condition of baptism, to which some responded by learning the translation of the gospel of Mark by heart: this was considered easier than learning to read the defective orthography. As for Catholics, they were using several different orthographies devised by expatriate priests, one of whom had even soldered self-made special characters onto his own manual typewriter. None of these early attempts gained widespread usage and no literacy campaign had ever been undertaken in any of them (Bolli, 1983, p. 4). One of the priorities of the SIL researchers who arrived in 1970 was to initiate a more substantial community-based programme of language development.³ In doing so, they were faced with two formidable challenges.

Firstly, Dan has over forty dialects. A sociolinguistic survey undertaken in 1970 in twelve of these (Bolli et al. 1972) revealed that mutual intelligibility between neighboring dialects was 100%, but that between one end of the continuum (Biankouma) and the other (Goulaleu) it was only about 30%. The dialect differences were in the lexicon, the grammar and the phonology, especially the tone system. On the basis of these findings, two varieties were chosen for development and standardization: Western Dan, based on the Blo dialect, and Eastern Dan, based on the Gwèta dialect, with the Cavally river separating the two.⁴

2. Much of the historical information in this section and the next is based on information found in the SIL Abidjan archives. These are much more extensive for the period 1970–1992 than thereafter and even within that period it is not always clear whether references to Dan concern the eastern or western variety or both.

3. In spite of this, as far as we are aware, no language committee was formally set up to deal with orthography decisions. It was not until 1998 that the *Ligue pour la Promotion de la Langue Dan* – one of seven leagues in a wider national network – was created, many years after the major orthography issues had been dealt with.

4. Bolli et al. (1972, p. 16) predicted that the central cantons of Blouno, Gouané and Oua would be able to use both orthographies and still held this opinion two decades later (Bolli, 1991a, p. 4).

The survey also showed that, among the eastern dialects, the Gwèta variety – spoken in and around the Santa Subprefecture (Biancouma department, Tonkpi region) – was the best understood, and that residents of Santa did not understand dialects further afield than Man. Some also considered Gwèta to be the most prestigious variety. Another consideration was the presence of two small linguistic islands in the Touba prefecture, which are separated from the Dan homeland by the Mahou ethnic group. One of these populations, Klaa, is situated in twelve villages west of Touba. The other inhabits seven villages south-east of Touba, in the area around Mount Zaala. According to the survey, these far-flung populations understood the Gwèta dialect better than they did the more populous Man dialect (Bolli, 1991a, pp. 10–11).

Some literacy stakeholders are now beginning to call into question the wisdom of choosing Gwèta as the reference dialect, given that Man has a much denser concentration of Eastern Dan speakers. Indeed, as late as 1988, Bolli (1991a, p. 4) was unsure whether the Eastern Dan primer was suitable for the whole eastern zone, because usage was much less widespread than the equivalent publication in the Western zone. However, the positive results of trials in Man and Lougoualé persuaded her otherwise.

The second challenge that the SIL researchers faced was the exceptionally large inventories for both vowels and tone in Dan. For vowels, the orthography developers, mindful of the francophone political penchant of the Houphouët-Boigny régime, chose numerous French spelling conventions. This orthography was implemented in 1974, but was only in use for eight years. In the late 1970s, the *Institut de Linguistique Appliquée* (ILA) – the department of the University of Abidjan with the mandate from the government to standardize Ivorian alphabets – in collaboration with SIL began an initiative to unify Ivorian orthographies and in doing so to move away from the French influence (Thomas, 1978, p. 4). Dan orthography developers, rather unwillingly, bowed to national level pressure in 1982 (Bolli, 1991a, p. 1), bequeathing the mixture of special characters, diereses and digraphs that are still in use today.

For tone, decision makers chose a daring and novel strategy involving word initial and word final marks borrowed from punctuation and mathematics. These could easily be produced on manual typewriters, which was a primary consideration before the IT revolution (Bolli, 1978, 1989, 1991b) and left the superscript position available for diacritics distinguishing vowel quality. According to Thomas (1978, p. 13), older Dan readers who had initially learned to read without tone marks resisted the new way of writing, but those who made the effort to adapt to it found that it greatly facilitated reading fluency.

Indeed, the novel strategy was greeted with great enthusiasm in Côte d'Ivoire at the time and was quickly adopted in fifteen other Mande, Kru and Kwa languages as well as being validated nationally by the government (ILA, 1979, pp. 18–21).

Although it has remained an almost exclusively Ivorian tradition,⁵ it has nevertheless attracted some attention among writing systems researchers (Frieke-Kappers, 1991; Kutsch Lojenga, 1993, pp. 13–14; 2014, pp. 57–58; Roberts, 2013, p. 91).

In 2014 Valentin Vydrin proposed a radical orthography reform replacing the punctuation marks with superscript diacritics and ensuring a biunique correspondence between phonemes and graphemes at the segmental level (Vydrin, Zeh, & Nestor, 2019). Eastern Dan was intentionally included in our series of experiments with the proposed reform in mind, and this was followed by a second experiment in 2017 specifically testing the 1982 and 2014 orthographies against each other (Roberts et al. 2019). In December 2018, the 2014 orthography was unanimously adopted by a meeting of orthography stakeholders (Zeh, 2018).

However, it is only the 1982 orthography that is the focus of the research reported in this book. Figure 2 shows a text sample to show the visual effect of full tone marking with punctuation symbols.⁶

-Yö -kè yi do 'ka -gbeng waa- 'gben- -wo -kè "taongdèdhe 'gü, 'wo =nièè wo 'ko "piü. 'Yö- -nu
-wo -yö -kè do kö -wo "kpaó 'sü kö -wo 'dho see" =kwaan-. 'Dhe 'wo -wo, 'yö -gbeng =ya- pö
'gben- -dhe : < Ma =nè 'a 'dèdè, =ya 'go mü ma =nè 'ö "yan 'gü 'ö -kan, =dhe 'ö "dhü ma =nè 'a
dho -da "dhü -bha. Bhi zè -bhö 'to "siaa kö 'ü see" -wlö kö 'ü -a -da "kpaó 'gü. »

Figure 2. Eastern Dan written with full tone marking (1982 orthography)

1.3 Previous research

Apart from an early mention by Westermann and Bryan (1952, pp. 39–40), previously published research on Eastern Dan falls roughly into two chronological phases. Early research includes a phonology sketch (Bearth & Zemp, 1967), as well as studies on tone (Flik, 1977) and mutual intelligibility of dialects (Bolli et al., 1972).

The ensuing silence of thirty years was broken by Valentin Vydrin's interest in the language, which has manifested itself in analyses of adjectives (2007), nominal declination (2011), tonal inflection (2016), quantifiers (2017b), pronominal predicative markers (2013), a condensed grammar in Russian (2017a), two editions of a bilingual Eastern Dan – French dictionary containing a grammar in French (Vydrine & Kességbeu, 2008; Vydrin 2021), and an overview of the language

5. Beyond Côte d'Ivoire, the only language we are aware of that marks tone fully and phonographically by means of word-initial and -final punctuation is Eastern (Tchien) Krahn (Sauder & Wright, 2000). Duitsman (1986, p. 3), in an article that reports on an informal test of this strategy in Western Krahn, mentions that at that time it was already being used in Northern (Eh Jeh) Grebo; however, this is no longer the case (Jim Laesch, p.c.). All three languages belong to the Kru family and are spoken in Liberia.

6. For the origin of this text and a free English translation, see p. 30, footnote 8.

(Vydrin 2020). References to Eastern Dan are also found throughout the same author's wider work on the Mande family (2009a, 2009b, 2010, 2012; Vydrine, 2002, 2006, 2009, 2010).

1.4 Typology

Eastern Dan is a highly isolating SOV language with very few affixes. The main rhythmical unit is the featural foot (Vydrine, 2010). Syllabic structures allowed in Eastern Dan are: V, CV, C₁C₂V. Permissible foot structures are CV, CVV, CVŋ, CVVV, CVVŋ, CCV, CCVV, CCVŋ, and CCVVŋ. Only the phoneme /l/ is licensed in the second C slot of a syllable onset. Nasal vowel harmony occurs within the scope of a featural foot. Vowel elision occurs in rapid speech.

1.5 Consonants

Eastern Dan has 17 consonant phonemes. Table 1 presents the grapheme-phoneme correspondences in the standard orthography.

Table 1. Consonantal grapheme-phoneme correspondences in the 1982 Eastern Dan orthography (Bolli & Flik, 1982, p. 4; Vydrine & Kességbeu, 2008, pp. 9–10)

| | Labial | Dental | Palatal | Velar | Labio-velar |
|----------------------|-----------|-----------|---------|-------|-------------|
| Voiceless stops | p | t | | k | k̠p, kw |
| Voiced stops | b | d | | g | g̠b, gw |
| Voiceless fricatives | f | s | | | |
| Voiced fricatives | v | z | | | |
| Implosives | ɓ <bh, m> | ɗ <dh, n> | | | |
| Continuants | | l <l, r> | y | | w |

The 1982 orthography contains three cases of consonant over-representation:

- <l, r>: the phoneme /l/ is pronounced [r] and spelled <r> following a coronal consonant (/t, d, s, z, ʃ/)⁷ and [l] elsewhere;
- <bh, m>: the phoneme /b/ is pronounced and spelled [m] <m> preceding a nasal vowel and [ɓ] <bh> elsewhere;
- <dh, n>: the phoneme /d/ is pronounced and spelled [n] <n> preceding a nasal vowel and [ɗ] <dh> elsewhere.

The allophonic graphemes <r, m, n> were all included in the orthography out of a desire to facilitate transition to and from French; their presence also conforms to regional practice.

7. In Gwèta: /t, d, ʃ, ʒ, y/

1.6 Vowels

Eastern Dan has a rich inventory of vowel phonemes, twelve oral and nine nasal, each of which can occur as single vowels or as sequences of two identical vowels. The velar nasal /ŋ/ is also best interpreted as a vowel with a restricted distribution, because it occurs in the same phonotactic slot as vowels and bears tone as vowels do.⁸ This brings the total number of vowels to 22. Table 2 shows how these were represented in the original Dan orthography, with its strong emphasis, again, on ease of transfer to and from French.

Table 2. Vocalic grapheme-phoneme correspondences in the 1974 Eastern Dan orthography (based on Thomas, 1978, p. 3)

| Oral | | | Nasal | | |
|-----------|---------|--------|-----------|---------|---------|
| Front | Back | | Front | Back | |
| Unrounded | Rounded | | Unrounded | Rounded | |
| | | | | | ŋ <ng> |
| i <i> | u <u> | u <ou> | ĩ <in> | ũ <un> | ũ <oun> |
| e <é> | ɣ <eu> | o <o> | | | |
| ɛ <è> | ʌ <e> | ɔ <ô> | ẽ <èn> | ã <en> | õ <ôn> |
| æ <èa> | a <a> | ɒ <aô> | æ̃ <èan> | ã <an> | õ̃ <aô> |

The 1982 orthography reform distanced itself from the French influence, and it is this system that was still in use at the time of the experiment. Table 3 presents the vocalic grapheme-phoneme correspondences in that orthography. In only seven cases are the grapheme and IPA symbols equivalent. The 1982 orthography contains three cases of vowel over-representation:

- <e, ɪ>: the phoneme /e/ is pronounced [ɪ] on or immediately after a xH tone syllable and [e] elsewhere;
- <o, u>: the phoneme /o/ is pronounced [ʊ] on or immediately after a xH tone syllable and [o] elsewhere;
- <ö, ü>: the phoneme /ɤ/ is pronounced [ɥ]⁹ on or immediately after a xH tone syllable and [ɣ] elsewhere.

8. In Tables 2 and 3, the phoneme /ŋ/ is positioned between the oral and the nasal series because, although it is nasal, it does not participate in nasal harmony. Oral and nasal vowels never co-occur within a foot but both are compatible with /ŋ/, e.g. /dãŋ/ <dhang> ‘heaven’, /dũũŋ/ <“nung> ‘hammock’.

9. Following Vydrine & Kességbeu (2008, p. 7), we use this symbol to indicate a near-close near-back unrounded vowel.

Table 3. Vocalic grapheme-phoneme correspondences in the 1982 Eastern Dan orthography (Bolli & Flik, 1982, p. 8; Vydrine & Kességbeu, 2008, pp. 7–9)

| Front | Oral | | Nasal | | |
|----------|-----------|----------|-----------|---------|----------|
| | Back | | Front | Back | |
| | Unrounded | Rounded | Unrounded | Rounded | |
| | | | ŋ <ng> | | |
| i | u <ü> | u | ĩ <in> | ũ <ün> | ũ <un> |
| e <e, ɛ> | ɣ <ö, ü> | o <o, u> | | | |
| ɛ | ʌ <ë> | ɔ | ẽ <en> | ã <ën> | õ <on> |
| æ <ea> | a | ɒ <aɔ> | æ̃ <ean> | ã <an> | õ̃ <aɔn> |

The allophonic graphemes <i, ü, u> were relative latecomers to the orthography – they are not listed in the 1982 version of the orthography guide – following the discovery that they are contrastive in Man and some other dialects. They were incorporated somewhat reluctantly since they are not contrastive in Gwèta. As for the digraphs <ea, aɔ>, they were chosen because in Western Dan, which was developed first, the phonemes /æ, ɒ/ are pronounced as diphthongs with these phonetic qualities.

1.7 Tone

1.7.1 Generalities

Eastern Dan has five phonemic level tones, xH, H, M, L, xL, which can be combined to produce four falling and two rising contours. All falling contours finish at the xL level; both rising tones begin at the M level (Flik, 1977; Vydrine & Kességbeu, 2008, pp. 10–11). No automatic downstep is attested, but declination of L tones occurs in utterance final position.

Languages with five discrete level tones are extremely rare. Besides Eastern Dan, the only other case where it has been reported in Africa, to our knowledge, is Bench (Omotic, Ethiopia; Wedekind, 1983, 1985a, 1985b).¹⁰ Beyond Africa, we can add Ticuna (Isolate, Peru; Anderson, 1959), Trique (Otomanguean, Mexico; Elliot et al., 2016; Longacre, 1952), Quiotepec Chinantec (Otomanguean, Mexico; Castellanos Cruz, 2014), Gaoba Dong (Tai-Kadai, China; Shi et al., 1987), and at least some languages of the Miao-Yao subgroup (Hmong-Mien, China; Chang, 1953).¹¹ In West

10. Paterson III (2015) lists Bench and Chori as having six pitch levels, but his concern is phonetic transcription.

11. Our thanks to Steve Parker, Keith Snider, Peter Unseth and Brendon Yoder for their help in establishing this list. See also Edmondson & Gregerson (1992). Steve Parker (p. c.) considers that it may be possible to re-analyze at least Ticuna and Trique as having fewer tones. See also Paterson III (2015) on the difficulties of transcribing languages with multiple pitch levels.

Africa, then, Eastern Dan occupies an unchallenged position in terms of its tonal repertoire. We purposely included it in the experiment with this in mind, in spite of the fact that the orthographic representation of tone is radically different from any of the other focal languages.

1.7.2 *Tone orthography*

The 1982 orthography uses punctuation symbols placed word initially and word finally to signal tone (Table 4). Level tones are marked preceding the word. As for contour tones, the general rule is that the first tone is marked word initially and the second tone word finally (Bolli, 1978, pp. 12–13; 1989; Bolli & Flik, 1982).

The earliest version of this orthography underdifferentiated the xH and H tones; they were both written with a preposed apostrophe, e.g. /gǎ/ <'gan > *burden*; /kś/ <'kô > *house*. Also, L tone was written with a preposed stop /zè/ <.zè > *termite* (Thomas, 1978, p. 12). This was eventually revised, and change was maintained in the 1982 orthography (Table 4).

Table 4. Inventory of Eastern Dan tones and their graphic equivalents in the 1982 orthography

| | | IPA | orthography |
|---------------|----------------------|---------|-------------|
| Level tones | Extra high | /ᵒ̊/ | <"ᵒ> |
| | High | /ᵒ̄/ | <'ᵒ> |
| | Mid | /ᵒ̃/ | <ᵒ> |
| | Low | /ᵒ̌/ | <_ᵒ> |
| | Extra low | /ᵒ̋/ | <-ᵒ> |
| Falling tones | Extra high – falling | /ᵒ̊ᵒ̋/ | <"ᵒᵒ-> |
| | High – falling | /ᵒ̄ᵒ̋/ | <'ᵒᵒ-> |
| | Mid – falling | /ᵒ̃ᵒ̋/ | <ᵒᵒ-> |
| | Low – falling | /ᵒ̌ᵒ̋/ | <_ᵒᵒ-> |
| Rising tones | rising – high | /ᵒ̊ᵒ̄/ | <ᵒᵒ'> |
| | rising – extra high | /ᵒ̊ᵒ̊̊/ | <ᵒᵒ"> |

Some orthography stakeholders consider one aspect of the symbol choice to be counter-intuitive. One might legitimately expect the two single stroke symbols <'ᵒ, -ᵒ> to indicate H and L, respectively, and the two double stroke symbols <"ᵒ, =ᵒ> to indicate xH and xL, respectively. The reason for the contrary choice for L and xL is historical. The Western Dan orthography was created first, and it has only four contrastive level tones which are marked orthographically as <"ᵒ 'ᵒ ᵒ =ᵒ>, respectively. When, later on, the Eastern Dan orthography was developed, decision makers considered it a high priority for the two orthographies to be as similar as possible. So the extra symbol <-ᵒ> was added to the existing inventory

to represent the additional xL tone, with no consideration for its iconic value. This meant that, paradoxically, Eastern Dan later found itself out of step with national level recommendations (ILA, 1979, p. 20), in spite of being one of the varieties of the very language for which the system had originally been developed.

By far the majority of Eastern Dan words contain one featural foot, and any words with three feet or more tend to be compounds. The fact that the 1982 orthography is incapable of marking tone on word-medial feet leads to a limited amount of under-representation. Curiously, even two-feet words are not written with a tone mark in word final position, even though they could be, and even though this under-representation sometimes generates homographs (1).

- (1) a. /g̃bāp̃l̃/ <gbapë> (*<gbapë->) *object of adoration*
 b. /g̃bāp̃l̃/ <gbapë> *fine, penalty*

This may be why writers sometimes split compounds into separate words, driven by the felt need to mark all the tones (2).

- (2) a. /s̃áǎgw̃l̃/ <'sëë- -gwë> *whetstone*
 b. /g̃x̃úúǎǎgw̃l̃/ <göüng" -gwë> *silicon*
 c. /d̃l̃nk̃p̃óóǎǎ/ <'në 'kp̃o dhe> *child-bearing*

Contour tones – for example H-xL (3a) and M-xL (3b) – occur on single syllable. The punctuation system handles these in the same way as any other one-foot word, that is, with punctuation symbols in word initial and final position.

- (3) a. /d̃ú/¹² <'dü-> *spear*
 b. /d̃ĩ/ <din-> *hunger*

1.7.3 Tonal processes

Eastern Dan has an almost entirely stable tone system. In fact, the only example of a contextual tonal process we are aware of concerns a series of demonstrative adverbs whose lexical M tone is replaced by H if preceded by another M (4).

- (4) a. /b̃ū/ → [m̃ū] <mü> *there*
 b. /ỹ́ d̃ō b̃ū/ → [ỹ́ d̃ō m̃ú] <'yö dho 'mü> *and he/she went there*

1.7.4 Lexical tone

Example (5) presents a representative sample of the vast number of tonal minimal pairs, triplets, quadruplet and quintuplets among Eastern Dan nouns.

12. The circumflex is used to indicate H-xL in Eastern Dan phonemic transcriptions, since HL contours do not exist.

- (5) a. /t́/ <'tɔ> *name*
 /t̀/ <-tɔ> *chicken*
- b. /yēē/ <yεεn> *evening*
 /yēē̄/ <'yεεn-> *moment*
 /yēē̄̄/ <"yεεn> *1. sand; 2. tree (sp.); 3. dream*
- c. /sēē/ <"sεε> *sponge*
 /sēē̄/ <"sεε-> *witness*
 /sēē̄̄/ <=sεε-> *salvation*
 /sēē̄̄̄/ <sεε"> *mat*
- d. /gb̄á/ <"gban> *thigh*
 /gb̄ā/ <gban> *shoulder*
 /gb̄à/ <-gban> *1. pressure; 2. ceiling*
 /gb̄ã/ <-gban> *support*
 /gb̄â/ <'gban-> *1. tree (sp.); 2. ant; 3. din; 4. curse*

Lexical tonal minimality is much less frequent among verbs (6).

- (6) a. /gā/ <ga> *die*
 /gà/ <-ga> *look*
- b. /b̄á/ → [m̄á] <'ma> *put*
 /b̄ā/ → [m̄ā] <ma> *1. cook; 2. hear*
 /b̄à/ → [m̄à] <-ma> *hit*

Notice, too, that the exceptionally large tone and vowel inventories in Eastern Dan by no means succeed in eliminating homophony, so even though tone is written fully the degree of written ambiguity remains relatively high.

1.7.5 Grammatical tone

The extraordinarily heavy lexical functional load of tone in Eastern Dan is thoroughly matched by its role in the grammar. Grammatical contrasts are often characterized by the lowering of tones, and exploit the xL tone in particular. We identify eight areas of the grammar that generate tonally minimal distinctions: infinitives (Section 1.7.5.1), the neutral aspect (Section 1.7.5.2), pronominal predicative markers (Section 1.7.5.3), the conjoint status marker (Section 1.7.5.4), the construct state marker (Section 1.7.5.5), nominalization (Section 1.7.5.6), case in locative nouns (Section 1.7.5.7), and adjectival intensive plurals (Section 1.7.5.8).

1.7.5.1 Infinitives

The infinitive is marked by a syllable-final tone change. In example (7) the lexical M tone conveys the perfective, whereas in example (8) the same word is pronounced with a falling contour to convey the infinitive (based on Vydrin, 2016, p. 96).

- (7) /bɛ́ ʻ dʻɛ́ yʻ ɿ̃ dè dā/
 [mɛ́ ʻ dʻɛ́ yʻ ɿ̃ dè dā]
 <'Mε 'ö 'dhö -yö ö -de dha.>
 human\REL REL.3SG.CJT be 3SG.SBV REF.SG self save
Every man for himself!
- (8) /ká wɔ́ sà k̄l̄ zlàà dò k̄a dā`/
 [ká wɔ́ sà k̄l̄ zràà dò k̄a dā`]
 <'Ka 'wɔn -sè kè -Zlaan -dho ka dha->¹³
 2PL.PER matter good do God go\NEU 2PL.NSJ save-INF
If you (pl) do good deeds, God will save you (pl).

1.7.5.2 Neutral Aspect

The neutral aspect – which expresses an extremely variable range of meanings, including the habitual and the progressive – is marked with an xL tone on the verb root. In Example (9), the verb “speak” appears in its lexical form. In Example (10), it is pronounced with an xL tone signaling the neutral aspect (Vydrin, 2016, p. 98).

- (9) /yà wě ɿ̃ yūúɖɿ̃/
 <=Ya "wɪ ö yuundhö.>
 3SG.PER speak REF.SG nose.LOC
He/She has snuffled.
- (10) /yʻ wè ɿ̃ yūúɖɿ̃/
 <-Yö -we ö yuundhö.>
 3SG.EXI speak.NEU REF.SG nose.LOC
(S)he snuffles.

Table 5 illustrates this further (based on Vydrine, 2002, p. 259).

Table 5. Tonal minimal pairs among lexical and neutral forms

| Lexical | | Neutral | | |
|-----------------|----------|-------------------|----------|-------------------|
| /bū/ → [mū] | <mü> | /bū̃/ → [mū̃] | <-mü> | <i>drink (v.)</i> |
| /dlā̃/ → [drā̃] | <draan-> | /dlā̃̃/ → [drā̃̃] | <-draan> | <i>teach</i> |
| /dīλλ/ | <-dhiëë> | /dīλλ̃/ | <-dhiëë> | <i>cool down</i> |
| /gó/ | <'go> | /gò/ | <-go> | <i>sell</i> |
| /gblá/ | <"gbla> | /gblā̃/ | <-gbla> | <i>yell (v.)</i> |
| /klō̃/ | <kloo> | /klō̃̃/ | <-kloo> | <i>thresh</i> |

13. The word /zlä̃/ [zrà̃ ~ lžā̃] *God* is spelled <-Zlaan>, so it is an exception to the rule whereby /l/ is spelled <r> following a coronal consonant.

1.7.5.3 *Pronominal predicative markers*

Eastern Dan verb phrases contain pronominal predicative markers expressing person, number, TAM and polarity meanings. Their position is strictly fixed after the subject (if present; in practice, the subject is very often omitted) and before the verb (if intransitive) or before the direct object (in a transitive construction). Tables 6 and 7 show that contrast between auxiliary inflections is often expressed uniquely by tone (Vydrin, 2016, p. 97). Three sets differ only in tone: (i) existential, subjunctive, conjoint and (sometimes) imperative; (ii) perfect and negative subjunctive; (iii) presumptive, negative imperfective, and (sometimes) prospective and negative perfective.¹⁴

Table 6. Tonal minimal pairs among Eastern Dan pronominal predicative markers (speech)

| | SG | | | DUAL | |
|-----------------------|-----------|-------|-----------|---------|-----|
| | 1 | 2 | 3 | LOG | INC |
| Existential | ā | ī ~ ū | γ̃̃ ~ γ̃̃ | ̃̃ | kō |
| Conjoint | á | í ~ ú | γ̃̃ ~ ̃̃ | ̃̃ | kó |
| Subjunctive | á | í ~ ú | γ̃̃ | ̃̃ | kó |
| Imperative | – | – | ̃̃̃ ~ ∅ | – | kò |
| Perfect | ḃá [má] | ḃá | γ̃̃ ~ γ̃̃ | γá | kó |
| Negative Subjunctive | ḃá [má] | ḃá | γá | – | kó |
| Prospective | ḃāā [māā] | ḃī | – | – | kōō |
| Presumptive | ḃāā [māā] | ḃāā | γāā | – | kōō |
| Negative Imperfective | ḃáá [máá] | ḃáá | γáá | – | kóó |
| Negative Perfective | ḃíí | ḃíí | – | – | kóó |
| PL | | | | | |
| | 1 EXC | 1 INC | 2 | 3 | LOG |
| Existential | yī | kwā | kā | wò | wō |
| Conjoint | yí | kwá | ká | wó | wó |
| Subjunctive | yí | kwá | ká | wò | wó |
| Imperative | – | kwà | kà | – | – |
| Perfect | γá | kwá | ká | wà ~ wà | wó |
| Negative Subjunctive | γá | kwá | ká | wá | – |
| Prospective | yī | kwāā | kāā | – | – |
| Presumptive | γāā | kwāā | kāā | wāā | – |
| Negative Imperfective | γáá | kwáá | káá | wáá | – |
| Negative Perfective | γíí | – | – | – | – |

14. Tables 6 and 7 are not intended to show complete paradigms of Eastern Dan pronominal predicative markers; they present only cases of tonal minimality. The 3sg subjunctive pronominal predicative marker may elide.

Table 7. Eastern Dan pronominal predicative markers (1982 orthography)

| | SG | | | | DUAL |
|-----------------------|-------|----------|-----------|-----------|------|
| | 1 | 2 | 3 | LOG | INC |
| Existential | a | i ~ ü | -yö ~ =yö | ö | ko |
| Conjoint | 'a | 'i ~ 'ü | 'yö ~ 'ö | 'ö | 'ko |
| Subjunctive | 'a | 'i ~ 'ü | -yö | "ö | 'ko |
| Imperative | – | -bhö ~ ∅ | – | – | -ko |
| Perfect | 'ma | 'bha | =ya ~ -ya | yá | 'ko |
| Negative Subjunctive | 'ma | 'bha | 'ya | – | 'ko |
| Prospective | maa | bhii | – | – | koo |
| Presumptive | maa- | bhaa- | yaa- | – | koo- |
| Negative Imperfective | 'maa | 'bhaa | 'yaa | – | 'koo |
| Negative Perfective | 'bhii | 'bhii | – | – | 'koo |
| PL | | | | | |
| | 1 EXC | 1 INCL | 2 | 3 | LOG |
| Existential | yi | kwa | ka | wo- | wo |
| Conjoint | 'yi | 'kwa | 'ka | 'wo | 'wo |
| Subjunctive | 'yi | 'kwa | 'ka | wo- | "wo |
| Imperative | – | -kwa | -ka | – | – |
| Perfect | 'ya | 'kwa | 'ka | =wa ~ -wa | 'wo |
| Negative Subjunctive | 'ya | 'kwa | 'ka | 'wa | – |
| Prospective | yii | kwaa | kaa | – | – |
| Presumptive | yaa- | kwaa- | kaa- | waa- | – |
| Negative Imperfective | 'yaa | 'kwaa | 'kaa | 'waa | – |
| Negative Perfective | yíi | – | – | – | – |

1.7.5.4 Conjoint status marker

The conjoint (or dependent) construction is expressed by lowering the tone on the verb root morpheme (11, 12; Vydrin, 2016, p. 98).

- (11) /gwà yà glüüüŋ/
 <-Gwë =ya glüüüŋ.>
 stone 3SG.PER roll
The/a stone has rolled.

- (12) /gwà dā ʔ glüüüŋ/
 <-Gwë =në 'ö -glüüüŋ.>
 stone FOC REL.3SG.CJT roll-CJT
It is the/a stone that is rolling.

The thirteen tone lowering patterns depend on the lexical tone of the verb and the featural foot structure.

1.7.5.5 Construct state marker

In certain types of inalienable possessive nominal constructions, the construct state marker on the noun root is expressed by means of an xL tone replacing the lexical tone (13; Vydrin, 2016, p. 99).

- (13) a. /wǔ/ <'wɔn> *matter*
 /dũ wǔ/ <dü -wɔn> *sorcery (lit. magic matter)\IZF*
 b. /dũ/ <"dhü> *tree*
 /gǔǔ dũ/ <-göo- -dhü> *Iroko tree*

The rules governing the presence or absence of the construct state marker are not yet entirely clear, but it is present in whole-whole relationships (e.g. cassava plant; elephant carcass), and absent in part-whole relationships (e.g. cassava stem; elephant tusk).

1.7.5.6 Nominalization

The nominalization of a verb is marked by an xL tone replacing the lexical tone (Vydrin, 2016, p. 99). For example, the lexical tone of the verb “draw” is H, but when it is nominalized it is pronounced with an xL tone (14).

- (14) a. /tǔ/ *draw (water)*
 <'tɔ>
 b. /yí tǔ ká bíǎgā/ *rope for drawing water*
 <'yi -tɔ 'ka bhiëga>
 water draw\NOM with creeper

1.7.5.7 Case in locative nouns

Locative nouns number about 60 in Eastern Dan, and many of them are frequent in natural contexts. They are characterized by a declension system with six cases: common, locative, inessive, superessive, adessive and comitative. No single locative noun has all six forms; most have only two. Five locative nouns differentiate case (and sometimes number) uniquely by tone (15; Vydrin, 2016, pp. 100–101).

- (15) a. /gǔǔ/ <-gɛɛn> *on the feet (superessive)*
 /gǔǔ/ <gɛɛn> *with/by the feet (comitative)*
 b. /yǎǎ/ <"yaan-> *on the eye (superessive)*
 /yǎǎ/ <"yaan> *before the eyes of (comitative)*
 c. /kwǎǎ/ <'kwëë-> *on each other (superessive)*
 /kwǎǎ/ <"kwëë> *with each other (comitative)*
 d. /kǔǔ/ <-kɔɔ> *on the hands of (adessive)*
 /kǔǔ/ <kɔɔ> *with a hand (comitative)*
 e. /zǐǎǎ/ <ziaan> *road (common)*
 /zǐǎǎ ~ <ziaan- ~ *at the road ~ on the road (adessive)*
 zǐǎǎ tà/ ziaan -ta>

1.7.5.8 Adjectival intensive plurals

The singular and intensive plurals of some adjectives are uniquely distinguished by tone (16; Vydrine, 2007, p. 88). The 1982 orthography has no way of distinguishing between these, because the tonal difference is often in word medial position, which is unmarkable even if tone were marked on words of more than one foot.

- (16) a. /g̃b̃áŋ̃g̃b̃áŋ̃/ <'gbënggbëng> *long and fat* (sg)
 /g̃b̃áŋ̃g̃b̃áŋ̃/ <'gbënggbëng> *very long and fat* (pl)
 b. /sl̃áásl̃áá/ → [sr̃áásr̃áá] <"srëénsrëen> *sugary* (sg)
 /sl̃áásl̃áá/ → [sr̃áásr̃áá] <"srëénsrëen> *very sugary* (pl)

For an analysis of the level of written ambiguity in Eastern Dan in comparison with that of Elip and Mbelime see Roberts et al. (2020).

2. Literacy background

2.1 Literacy program

The SIL literacy program began in the Western zone in 1970 and in the Eastern zone in 1974.¹⁵ Early reports repeatedly state that motivation was exceptionally high, that the Dan people cherished “an intense, sustained, desire ... for reading their language” (Bolli, 1980, p. 7) and that they were known for their innate love of paper and their language (Bolli, 1983, p. 3). Thomas (1978, pp. 1, 14, 16) considers high motivation to be a hallmark of Dan that was absent in other ethnic groups, and notes that the majority of participants in the literacy classes were young people under the age of twenty. She goes as far as to call the early initiatives “spectacular”.

Literacy statistics bear this out. During the first year of literacy activities, in the western zone, over 100 teachers were trained (Bolli, 1983, p. 5). By 1982, 500 volunteer teachers had been trained in 40 training courses, with the result that between 1400 and 1800 people had learned how to read in both the Western and Eastern zones (Lauber, 1983, p. 2). Classes sometimes sprang up spontaneously in locations where the program coordinators had never even stepped foot. In 1978–1980, to cope with the demand, a three-level structure was developed (a central committee, three regional committees,¹⁶ and numerous local committees) for the promotion of Dan literacy and literature production (Bolli, 1980, p. 12). The initial enthusiasm was particularly strong in the UEESO¹⁷ churches, but later spread to all denominations.

15. We are unaware of any other organizations working in Dan literacy besides SIL at this time.

16. Committees representing Christian denominations were eventually found to be more effective than those representing geographic areas (Bolli, 1991a, p. 3).

17. Union des Eglises Evangéliques Services et Œuvres.

Unfortunately, this encouraging and optimistic start was not to last, because the 1982 orthography reform (see pp. 90–91) had an extremely negative impact. Bolli (1991a, p. 1) describes it as being “... like a cold shower to the whole literacy program. Classes stopped in most of the villages. People who had learned to read in the old orthography – a lot among them older people – were very discouraged at the prospect of having to learn yet another way of writing. To many it was like a radical change compelling them to start learning to read all over again.” (See also Bolli, 1992, p. 3; Thomas, 1978, p. 3).¹⁸

Furthermore, literacy had always been welcomed more in the Western zone. The Eastern zone had suffered from major setbacks, including the sudden death of a key partner and the refusal of certain Christian denominations to work together. So the orthography reform hit the Eastern zone particularly hard. Indeed, residents of Lougoulé expressed such fierce opposition to the 1982 orthography that UESSO classes in that location stopped completely for several years (Bolli, 1991a, pp. 11–12).

Nonetheless, as people slowly began to overcome their resistance to change, motivation for literacy began to pick up again in most locations, to the point where – particularly with the excitement over the publication of the New Testament in 1991 – it had never been higher in some areas (Bolli 1991a, p. 1). By the following year, literacy classes were taking place in over 100 locations with approximately 1000 students (Bolli, 1992, p. 3). The imminent publication of the New Testament also sparked interest from beyond the homeland. In 1990, the Dan diaspora created an association called *La Ligue pour la Promotion des Écritures en Yacouba* which organized a literacy course in Abidjan attended by 120 people in 1990 and 179 people in 1991 (Bolli, 1992). Meanwhile, back in the homeland, Dan literacy had reached almost the entire territory by 2002, with each sub-region, composed of at least 25 villages, having a regional league which reported to the national league, and an impressive number of literacy workers in each location (Anonymous, 2002).

In those heady days, no one could have anticipated the tragedy that was about to descend on Côte d’Ivoire, in the form of two civil wars in 2002–2007 and 2010–2011. The clashes, particularly violent in the far west of the country in and around Man, led to a massive exodus of the population. Some literacy workers who needed

18. Paradoxically, it was during this uncertain period that the success of the Dan literacy program began to attract attention nationally. In 1983, five literacy centers were created by the Ministère de la Jeunesse et des Sports which at that time was responsible for adult education. Also, the ILA, in collaboration with AFROLIT (Society for the Promotion of Adult Literacy in Africa), organized experimental training programs for new literates to transfer their skills from Dan to French (1980–1982) and pilot tests in which children learned Dan before beginning French school (1982–1984) (Bolli, 1992, p. 4).

medical attention were unable to get to hospital and died. Motorbikes and bicycles were requisitioned or stolen. Much of the Eastern Dan literature stock and administrative documentation was destroyed,¹⁹ not to mention whatever books were already in the hands of literacy workers and learners. Others, traumatized, completely lost their literacy skills.

It was only in 2012 that, timidly, literacy activities resumed. Organizing committees were re-established, the literature storeroom was re-stocked, and contact was renewed with 61 literacy teachers, although only five classes were re-opened due to lack of finances²⁰ (Anonymous, 2012, pp. 2, 5). The following years, up to 2018 when the program was reactivated, were characterized by the bare minimum of activities, largely due to the extremely limited funding. The few literacy classes in existence at the time of our experiment tend to attract middle-aged and older people and nothing was being done to pass literacy on to the younger generation. A census undertaken in 160 Eastern Dan villages in the department of Man (Kesseugbeu, 2008), revealed that out of 131,480 speakers, only 606 knew how to read and write their language, which is 0.46% of the estimated population.²¹

2.2 Literature production

Publications using the 1982 orthography consist of an orthography guide (Bolli & Flik, 1982), the New Testament,²² books of folktales, humorous stories, proverbs, proverbial names, booklets about agriculture and health, annual calendars, and the newspaper <-Pamebhamε> (*The Awakener*).

In addition, between 1974 and 1992, eight *Victor Hugo Writers' Workshops* were organized in Dan territory, half of them in the eastern zone. The aim was to generate new written materials in Dan, translate existing materials from other languages into Dan, and produce regular calendars and newspapers. The trainees were known as *Les Victor Hugo*, jokingly at first but then the name stuck. None had more than

19. This is why we are unable to provide literacy enrolment and graduation figures for the decade preceding the experiment as we have done in the introductory chapters to some of the other focal languages.

20. This was followed in 2013 by a course with 71 participants in four classes; in 2015 by a transition course with 56 participants in three classes; and in 2016 by a transition course with 27 participants in two classes (Emmanuel Zeh, p. c.).

21. The Eastern Dan literacy coordinator, Emmanuel Zeh (p. c.), vigorously disputes the accuracy of the census, considering the percentage to be much higher. Eberhard et al. (2020) give an L1 literacy rate of 1% for the whole Dan territory.

22. We have been unable to ascertain exactly how many New Testaments have been sold, but a 1993 literacy report mentions a second delivery of 5000 copies.

primary school education, yet they became pillars of the literacy program, sitting on organizing committees and working as interpreters and translators in addition to writing and publishing (Bolli, 1983).

2.3 Pedagogical materials

2.3.1 *Primer*

The Eastern Dan primer (Tiémoko et al. 1982/1994)²³ has an introduction for teachers that briefly explains the teaching order and presents the alphabet, comparing it with French and giving example words in Eastern Dan. The introduction ends with a list, in French, of the five level tones and six contour tones with their orthographic equivalents.

Lesson 1 teaches six sight words, two of which are identified with drawings (Figure 3).

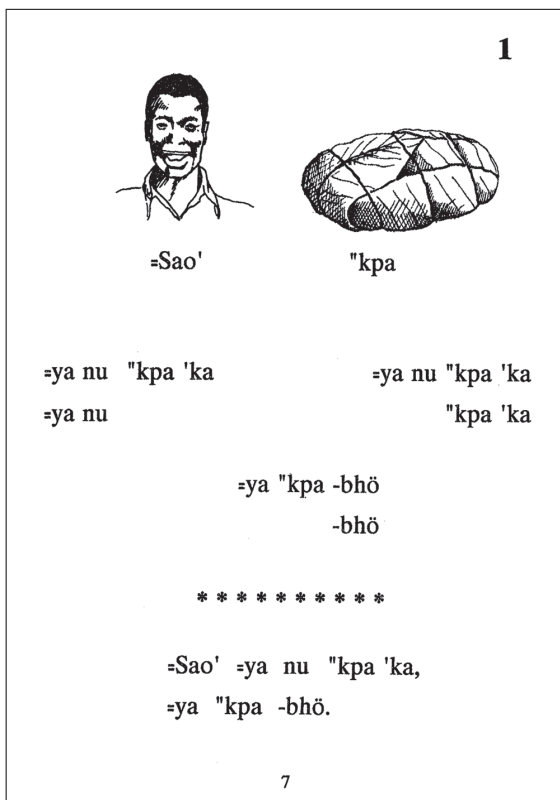
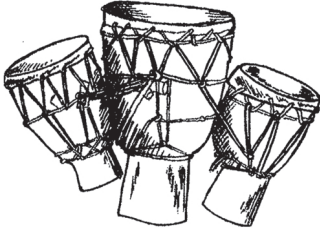


Figure 3. Eastern Dan tone introduced with keywords (Tiémoko et al., 1982/1994, p. 7)

23. The first edition of the Eastern Dan literacy primer appeared in 1975.

All five level tones are represented by the sight words. Additionally, the LH contour tone is represented by a proper name – even though this particular contour is not included in the initial list of tones. The two keywords of the second lesson are both H tone. This H tone is carried through on the drills; in fact, tone is written on every syllable and word in the primer. The lesson 3 keyword is a tonal minimal pair with one of the keywords from lesson 2. So even though the primer contains no designated tone drills, here and frequently throughout, the synthesis and contrast drills are in fact acting as tone exercises with tonal minimal pairs (Figure 4).

12



1

| |
|-------|
| -bhaa |
| -aa |

2

| | | | |
|-------|------|------|-----|
| "aa | "aa | "ɔɔ | "a |
| -aa | -aa | -ɔɔ | -a |
| -bhaa | -saa | -yɔɔ | -ya |

3

| |
|-------|
| -bhaa |
| -saa |
| "yɔɔ |
| -ya |

4

| | |
|-----|-------|
| "ya | "bhaa |
| 'ya | 'bhaa |
| ya | bhaa |
| -ya | -bhaa |
| =ya | =bhaa |

28

Figure 4. Eastern Dan synthesis and contrast drills functioning as tone drills (Tiémoko et al., 1982/1994, p. 28)

Lesson 4 introduces vowel length, without adding new letters or tones, although the grammar drill includes new sight words. Lesson 5 does not teach new letters but does introduce a disyllabic word with a new letter that seems to be residue (i.e. a letter that will be formally taught at a later point in the primer). The contrast drill has a three-way tonal contrast for each column of two different syllables. Again, the grammar drill introduces new sight words, but does not introduce any new tones. From lesson 5 onward, new letters are introduced via keywords except for review lessons.

Contour tones are not introduced until lesson 30, when a word with the xH-xL contour tone is used in the comparison and contrast drills, as well as in the story. Lesson 36 formally introduces H-xL tone. This tone pattern appears on the keyword and on all the syllables in the drills. Lesson 37 teaches M-xL, but the drills only contrast that pattern with the level tones. Lesson 38 teaches a new letter, yet the drills do not review either of the new tone patterns. Lessons 39 through 41 introduce new letters and digraphs but do include syllables with falling contours in their drills. Lesson 42 teaches the two rising tones, M-xH in the keyword, and M-H in the drills.

A significant strength of this primer is its focus on ensuring that students have adequate practice with the level tones before introducing contour tones. The use of compare and contrast drills for tonal minimal pairs is another strength. However, the teaching of contour tones is less satisfactory. In particular, new tone patterns are insufficiently reinforced in the following lessons. Normally, each new element should be practiced in the drills and story of the next lesson, and preferably in the next five lessons. As it is, for example, the H-xL tone is not reviewed in either the drills or the story of lesson 37; and lesson 38, which should review both falling contour tones, has neither in the drills and only four words in the story (three with M-xL, one with H-xL). Neither do the final thirteen lessons help learners consolidate their tone reading skills, as over half of these lessons do not include contour tones in their drills, although most have at least one word with at least one or another pattern in their stories. A final significant weakness is that the instructions to the teachers do not include writing lessons. The inclusion of these would reinforce students' reading ability and further develop tone awareness.

2.3.2 *Transition guide*

The Eastern Dan transition guide (Bolli & Flik, 2000)²⁴ is to be used in a class situation. An accompanying teachers' guide explicitly tells teachers that although some instructions are given, they may teach each of the five parts of the guide as

24. The first edition of the Eastern Dan transition guide appeared in 1994.

they wish. The introduction to the representation of tone is in the first section, but tone is the topic of the fourth lesson, after vowels and consonants have been taught.

Tone marks are introduced in the first part of the guide after drawing attention to the fact that Eastern Dan is largely monosyllabic, which is an important consideration for the tone orthography chosen. The students' notes point out that French does not have tone, but tone writing is indispensable for writing Eastern Dan. A tonal minimal quintuplet is given as an example, which the teacher is to read and then whistle to help students hear the difference. When the punctuation system was first introduced, teachers were encouraged to use the whistling technique (Thomas, 1978, p. 12) and this would seem particularly apt for a language in which whistle speech has been reported (Eberhard et al., 2020), but in practice, it appears to have fallen by the wayside. The teachers' guide, after warning the user that this concept will be the most difficult point to teach, gives an exercise to convince learners of the necessity of writing tone: students try to read a paragraph written on the board without tone marks. When they are unable to ascertain what it means, the teacher adds the tone marks and helps the learners to read it correctly.

The fourth unit, where tone is taught, introduces first the xH and xL tones, and then adds one level tone at a time in the following order: M, H, L. It then introduces the six contour tones in the following order: H-xL, M-xL, M-xH, M-H, xH-xL, L-xL. This presentation order, with the rising contours introduced in the middle of the four falling contours, may seem counter-intuitive but has the advantage of helping to highlight both distinctiveness and similarity of the tones and their orthography. At the beginning of the unit, students are told that Eastern Dan has eleven tone patterns, and a reference word for each is listed. The teacher reads the list, then whistles each word while students listen (Figure 5).

Then the exercises follow. The procedure, given in the teachers' notes, requires teachers to whistle or hum the reference words for the first two level tones (xH and xL). Then they whistle the reference word for xH and immediately after the tone for the first word on a list of fifteen words that are not marked for tone. Learners decide whether or not the tones of the two are identical. If they are not, then teachers whistle the reference word for xL, immediately followed by the tone of the first word on the list. Once the class has decided which tone belongs to the list word, the teachers write it on the board, and presumably the learners mark it in their books although no explicit directions are given. This procedure is followed for all the exercises, each time adding one more reference word to the procedure. When all the tones have been taught, teachers are encouraged to play one of the tone "games" suggested or to create their own. One potential game is for teachers to write a sentence on the board without tone marks, and have students determine the correct tones. The other suggested game has teachers write the tones of a proverb (using just one syllable,

11

Bloc 4: L'ENSEIGNEMENT DES TONS

Il y a en tout onze schèmes tonals en DAN "Gwɛɛtaawu. Chaque schème a un mot de repère qui sert à identifier les schèmes encore inconnus.

Mot de repère: Traduction française:

| | |
|----------|-------------|
| "dhü | arbre |
| 'kɔ | maison |
| dɛ | père |
| =ze | fermite |
| -dɔ | amour |
| "bhaang- | belette |
| 'zlaa- | petit-frère |
| gɔn- | homme |
| =gɔɔ- | bois iroko |
| mɛng' | Jula |
| puu" | gourde |

Exercice 1

Ce premier exercice sert à identifier les schèmes tonals **très haut** et **très bas**. Les mots de repère sont les suivants:

| | |
|------|-------|
| "dhü | arbre |
| -dɔ | amour |

Liste de mots

| | | | | | |
|---|------|----------|----|--------|------------|
| 1 | bɔ | cabri | 9 | kpa | sauterelle |
| 2 | dɛ | feuille | 10 | puu | blanc |
| 3 | dɛ | place | 11 | tɔ | sauc |
| 4 | yɪ | eau | 12 | gaan | paintade |
| 5 | gɔ | lête | 13 | gbeng | branche |
| 6 | zoo | chenille | 14 | kpenng | déhors |
| 7 | tɛng | temps | 15 | wɛɛ | malheur |
| 8 | yua | maladie | | | |

Notes pour l'enseignant:

Pour entrer dans les exercices, l'animateur lit d'abord tous les mots de repère ci-contre. Ensuite il les siffle, un à un. Il peut faire cela à plusieurs reprises, mais sans demander aux apprenants de l'imiter à ce point-ci.

Règles de la notation des tons:

N° 1: Si, dans un mot à deux voyelles, la hauteur tonale ne change pas, le ton est marqué une seule fois tout comme pour les mots à une voyelle.

N° 2: Si le mot à identifier comporte deux voyelles, il faut siffler pour la longueur de deux voyelles.

Pour le 1^{er} exercice, procéder de la manière suivante:

- L'animateur siffle ou boudronne la mélodie de deux mots de repère. Il fait cela plusieurs fois, l'un immédiatement après l'autre.
- L'animateur siffle le ton de repère pour le ton très haut et, immédiatement après le ton du premier mot sur la liste des mots ci-contre. Les apprenants jugent si les deux tons sont identiques ou non. Au cas où ils sont identiques, vous pouvez être sûr d'avoir trouvé le ton correct du mot bhu cabri.
- Si, par contre, les deux tons ne sont pas identiques, l'animateur siffle le ton du mot de repère pour le ton très bas et immédiatement après, le ton du mot bhu. Les apprenants jugent si les deux tons sont identiques ou non. Si vous trouvez que les deux tons sont identiques, il ne s'agit donc pas, dans le cas de bhu 'cabri', d'un ton très haut, mais plutôt d'un ton très bas.
- L'animateur place le signe pour marquer le ton très bas devant le mot bhu cabri (tirez simple).
- Répétez le même procédé pour le deuxième et continuez jusqu'à avoir identifié les tons de tous les mots sur la liste.

Figure 5. First page of the tone unit in the Eastern Dan teachers' guide (Bolli & Flik, 2000, p. 11)

with length where appropriate). The students, by humming or whistling the tones correctly, have to identify the proverb.

It is only in the fifth unit describing orthographic rules that students learn that the full tone pattern is only written on monosyllabic words. For polysyllabic words, tone is only written in word initial position. Readers are told they will then have to figure out for themselves the correct tone pattern for the word.

The Eastern Dan transition guide, properly taught, gives ample practice with the different tone patterns and tone marks on monosyllabic words. It is limited, however, in the amount of practice it gives students with polysyllabic (compound) words, and with texts. Although the answers to the tone exercises are given in the appendix, students would be unable to learn independently given the lack of printed instructions. However, given the number of tone patterns in the Eastern Dan tone system, it is unlikely that students would learn the tone orthography well independently; the development of a transition guide for class use only was probably a wise choice.

Yoruba (*Matthew Harley, JeDene Reeder*)

1. Linguistic and orthographic background

1.1 Affiliation and location

Yoruba¹ is one of Africa's major languages,² with most population estimates ranging between 20–30 million. It is spoken mainly in southwestern Nigeria, throughout Lagos, Ogun, Ondo, Osun, Ekiti and Oyo States, as well as the southern part of Kwara State and the western parts of Kogi and Edo States (Figure 1). Significant populations also live in southern Benin east of the Ouémé river, as well as in Liberia, Sierra Leone, the Caribbean, Brazil and Argentina.

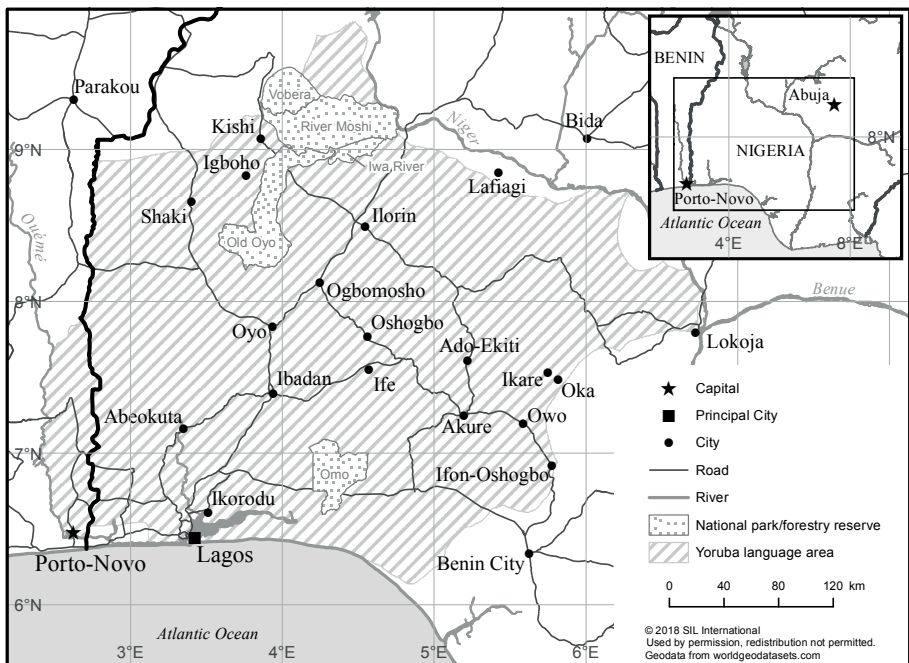


Figure 1. The Yoruba language area

1. ISO 639–3: yor. Glossonym: [èdè yòrùbá] <Èdè Yorùbá>. Ethnonym: [yòrùbá] <Yorùbá>.
2. Yoruba is arguably Africa's third largest language in terms of L1 speakers, after Arabic (if all spoken varieties are counted together) and Hausa.

Genetically, Yoruba is part (and the historical origin) of the Ede³ continuum of languages, which stretches from Yoruba in Nigeria in the East, through Idaasha in central Benin, to Ife in Benin and central Togo in the West (Kluge, 2007, p. 2; 2011, p. vii).⁴ All three of these varieties are focal languages in our series of experiments, and they are the only Ede varieties to have so far undergone significant language development.

Yoruba has around 20–30 different dialects,⁵ split into five broad dialect areas (Akinkugbe, 1978, p. 23; Akinlabi, 2001, p. 836). Standard or Common/Koine Yoruba (as taught in Nigerian schools) is largely based on the Ọ̀yọ̀ dialect, although some extreme Ọ̀yọ̀ regionalisms have been removed (Courtenay, 1968, p. 1), while other forms not found in the Ọ̀yọ̀ dialect have been included (Bamgboṣe, 1966b, p. 2). Thus Standard Yoruba is sometimes considered an artificial construct not based on a single homogenous dialect, and only spoken by the educated elite (Ogunbiyi, 2003, p. 79).

The main second language spoken by Yoruba speakers in Nigeria is English. Borrowings are mainly from English and Hausa. Many Arabic words have also entered the language, often via Hausa, through extensive trade and cultural relations between the Yoruba and Hausa since the 15th century.

1.2 Orthography development

The first recorded use of the Roman script for Yoruba was by Thomas Edward Bowdich in 1817 (Ògúndèjì, 2016, p. 256), but it was not until the 1840s that Yoruba documentation began in earnest, largely as a result of the Church Missionary Society (CMS) working with freed slaves in Sierra Leone. One of these was Samuel Ajayi Crowther, the first native speaker to write Yoruba in Roman script, and the preeminent name in early Yoruba scholarship. Like previous attempts to write Yoruba, Crowther's early work did not use any diacritics, and as there was significant variation among the orthographies in use at the time, the CMS proposed a standard African alphabet (CMS, 1848), which was the first to introduce a system

3. The term “Ede” was proposed by Capo (1989, p. 281), since this word means “language” in all varieties of this cluster.

4. Kluge's (2011, p. vii) survey mentions 46 distinct Ede varieties.

5. Ògúndèjì (2016, p. 256) reports at least 22 dialects in Nigeria. Kluge (2011, p. vii) identifies 13 varieties of Southeastern Ede, all spoken either in Nigeria or just over the border in Benin, while Capo (1989, pp. 278–281) mentions a further 18 varieties, all spoken in Nigeria. Hence the Southeastern Ede cluster, which many would see as synonymous with the term ‘Yoruba’, comprises up to 31 lects.

of subscript pointing for vowels and superscript accents for tone. This orthography survived with few changes for over a century. Variations in spelling continued however, until Crowther chaired a major CMS conference on the Yoruba language in 1875, which recommended a partial tone-marking system in which all monosyllabic words were marked, while most polysyllabic words had only their first or last syllables marked (Ajayi, 1960, pp. 55–56; Olúmúyiwá, 2013, p. 41). In addition, it recommended the use of tildes to mark contour tones, and doubled consonants to differentiate certain tonal minimal pairs.

The next orthographic milestone came with the publication of Bamgboṣe's Yoruba Orthography (1965), which led to the setting up of a *Yoruba Orthography Committee* in 1966. This committee's two reports (Ministry of Education, 1969, 1972) quickly became the orthographic standard in schools throughout the region. Meanwhile, in 1971, the *Committee of Vice-Chancellors* set up a *Yoruba Working Party*, which made a few further changes, mostly based on convention. When the *Federal Ministry of Education* formally received all three reports in 1973, they referred them to the *Joint Consultative Committee on Education (JCCE)*, which formally approved the *Yoruba Working Party's* orthography, and recommended that it be adopted throughout the Yoruba-speaking area (FME, 1974). These remain the current official guidelines for the orthography, and include the recommendation that tone marking is only required at the author's discretion, depending on whether it is deemed necessary for the purpose of disambiguation. In practice however, most teachers found this rule rather hard to implement consistently, and so typically instructed students to use full tone marking, leaving only M tones unmarked. Thus full tone marking became the norm in textbooks and formal publications, even though it is not strictly required by the official guidelines.⁶

Of the ten biggest language populations in Africa, three are non-tonal (Arabic, Swahili, Fulfulde), and six are tone languages that do not mark tone in their orthographies or only do so in very limited contexts (Shona, Zulu, Lingala, Hausa, Igbo, Akan). Yoruba is therefore the only major African language whose orthography marks tone fully. Figure 2 shows a text written in the standard Yoruba orthography to show the visual effect of full tone marking.⁷

6. The Beninese Yoruba orthography differs segmentally from the Nigerian one, using the graphemes <ɛ, ɔ, sh, kp> instead of <ẹ, ọ, ṣ, p> to represent /ɛ, ɔ, ʃ, kp/ respectively, following Beninese government recommendations. Tone marking conventions are the same on either side of the border (Bada, 2008).

7. For the origin of this text and a free English translation, see p. 30, footnote 8.

Òkéré àti ajá jé òrè tímótímó. Ní ojó kan, òkéré àti ajá mú àpò, wón lọ sí oko ọsàn. Nígba tí wón dé ibẹ̀, òkéré wí fún ajá wí pé, “Sé o mò pé mo mò igi gùn dárádára. Mo sì kéré púpò. Jé kí èmi gun igi ọsàn, kí iwọ dúró sí isàlẹ̀, kí o sì máa he ọsàn. Èmi ó máa ju ọsàn nàà sí ọ, ó sì máa fi sí inú àpò.”

Figure 2. Yoruba written with full tone marking (Standard orthography)

1.3 Previous research

Yoruba, as one of Africa’s most documented languages, has been the subject of linguistic descriptions for over 160 years. The Glottolog website⁸ lists 950 entries of books or articles on the Yoruba language, including 109 grammars or grammar sketches, 62 phonologies and 27 dictionaries. Prominent among these are the grammars by Délànò (1965, 1969), Bamgboṣe (1966b), and Awobuluyi (1979); the dictionaries by Crowther (1852a), Abraham (1958), Délànò (1969), and Fákínlèdè (2003); and the phonologies by Awobuluyi (1964) and Oyelaran (1971). Another significant work will be Akinlabi’s phonological grammar (Akinlabi, in preparation). The tonal phonology of Yoruba is relatively well known through the descriptions of Ward (1952), Hombert (1977), Akinlabi (1985), Connell & Ladd (1990), Laniran (1993, 1995), Laniran & Clements (1995, 2003) and Akinlabi & Liberman (1995, 2000). More substantial summaries of previous research on Yoruba can be found in Baloubi (2005, pp. 28–29) and Adéwolé (1987), as well as in the recent *Encyclopedia of the Yoruba* (Falola & Akinyemi, 2016). Yoruba is also the only focal language that has been the subject of previous tone orthography experimentation (Fagbòrun, 1989; Klem, 1982). For a discussion of their contribution to the domain, see Roberts (2008) and pp. 226 and 270 of this volume.

1.4 Typology

Yoruba is a highly isolating language with SVO basic word order. The only permissible syllable structures are V, CV and N (syllabic nasals). Virtually all simple verb roots have monosyllabic CV structure, and the majority of nouns have VCV structure. Other major word classes begin with consonants and are disyllabic or longer. The major word-building morphological processes are prefixation, reduplication and compounding.

8. <http://glottolog.org/resource/languoid/id/yoru1245> (accessed 29 March 2021).

1.5 Consonants

Yoruba has a fairly simple phonological inventory, with 18 consonant phonemes and 11 vowel phonemes (7 oral, 4 nasal). Table 1 presents the consonantal grapheme-phoneme correspondences in the Standard Yoruba orthography.⁹

Table 1. Yoruba consonantal grapheme-phoneme correspondences (based on Akinlabi, 2001, p. 837)

| | Labial | Alveolar | Palatal | Velar | Labio-velar | Glottal |
|---------------------|----------------|-----------|---------|-------|-------------|---------|
| Stop (voiceless) | | t | | k | kp <p> | |
| Stop (voiced) | b | d | ɗ̥ <j> | g | gb | |
| Fricative | f | s | ʃ <ɕ> | | | |
| Nasal | m <m ~ n ~ ng> | | | | | |
| Lateral approximant | | l <l ~ n> | | | | |
| Central approximant | | ɾ <r> | y | | w | (h) |

Although some authors (e.g. Akinlabi, 2004, p. 457) view /n/ as phonemic, others (e.g. Akinkugbe, 1978, pp. 62–65; Ladefoged, 1964, pp. 23–24) see no evidence for this, since [l] and [n] are in complementary distribution. Moreover, if /n/ were phonemic like /m/, then it is hard to explain why /e/, /ɛ/ and /o/ are permitted after /m/, but not after /n/ in monomorphemic roots.

The sound represented by the grapheme <r> is described as an alveolar flap in several descriptions (e.g. Bamgboṣe, 1966b, p. 7), although it is arguably more commonly pronounced as [ɾ]. Akinkugbe (1978, pp. 65–66) reports that [ɾ] and [r] are in free variation. I follow Akinlabi (2004, p. 457) in classifying it as an approximant along with /h/, on the basis that they participate in a natural class of five approximants /l, ɾ, y, w, h/ which have nasalized allophones [n, ɾ̃, ỹ, w̃, h̃] respectively before nasal vowels, although except for the l/n alteration, these are not marked in the orthography.

The syllabic nasal is realized as [ŋ] before a vowel, and can be spelled either as <n> or <ng> in such a position, although most writers prefer <n>. In other positions, it is homorganic to the place of articulation of the following consonant, being spelled as <m> before /b/, and as <n> in all other cases. When syllabic nasals occur following vowels, they nearly always carry tone marks to distinguish them from nasal vowels, which are spelled <Vn> (1; based on Fagbörün, 1989, p. 78):

9. Following Akinlabi (2004, p. 457), /ɗ̥/ is classed as a stop, rather than an affricate, since its pronunciation can vary between [ɗ̥] and [j]. Some dialects (e.g. Ekiti) appear to lack a phonemic /h/, and in some words in Standard Yoruba, [h] and [y] may alternate, as in [èyìn/èhìn] *back* (Przedziecki, 2005, p. 48).

- (1) a. /wǔ/ <wón> *to be dear*
 b. /kǎm̀k̀d̀/ <kòh̀k̀ò> *bull-frog*

The one exception to this is the emphatic 3rd person singular pronoun [òh̄ ~ òū] *he/she/it*, which is spelled <oun>.¹⁰

1.6 Vowels

Table 2 presents the grapheme-phoneme correspondences for the vowels. The mid-open vowels are often represented orthographically with a subscript dot,¹¹ to distinguish them from the mid-close vowels.¹²

Table 2. Yoruba vocalic grapheme-phoneme correspondences (based on Akinlabi, 2001, pp. 837–838)

| | | Oral | | Nasal | |
|-------|-------|--------|--------|----------|---------------|
| | | Front | Back | Front | Back |
| +ATR | Close | i | u | ĩ <in> | ũ <un> |
| | Mid | e | o | | |
| – ATR | | ɛ <ɛ̣> | ɔ <ɔ̣> | ɛ̣ <ɛ̣n> | ɔ̣ <ɔ̣n ~ an> |
| | Open | | a | | |

The phoneme /ɔ̣/ has been reported (Akinlabi, 2004, p. 456) as being in complementary distribution with /ạ/, whereby /ɔ̣/ occurs after labial consonants and /ạ/ occurs elsewhere. However /ɔ̣/ can replace /ạ/ in all cases, without any change in meaning, so /ạ/ is in free variation with /ɔ̣/, at least in Standard Yoruba. Thus /ɔ̣/ rather than /ạ/ is considered to be phonemic, as suggested in Bamgboṣe (1966b, pp. 7–8).

The phoneme /ɛ̣/ is extremely rare, leading some scholars (e.g. Pulleyblank, 1988, p. 237) to suggest that Yoruba really has only three nasal vowels: /ĩ, ũ, ɔ̣/.¹³ In Standard Yoruba, /ɛ̣/ appears to be a case of dialect borrowing (e.g. from the Ìjẹ̀bù dialect).

10. Fagbørun (1989, p. 85) recommends that all syllabic nasals could be written as <un> to avoid having to write tone marks on them.

11. Officially the subscript diacritic can be either a vertical line or a dot. The vertical line option was introduced during the 1875 conference to avoid obscuring the diacritic when underlining, but had been suggested as early as 1856 to prevent the frequent omissions of the dots in print (Ajayi, 1960, p. 55).

12. The pronunciation of the mid-open nasal back vowel /ɔ̣/ <ɔ̣n ~ an> is the same for most speakers, even though both spellings are tolerated.

13. Pulleyblank posits /ạ/ instead of /ɔ̣/ in the interests of symmetry.

Vowel length is not contrastive. Surface long vowels are usually the result of consonant deletion, vowel assimilation, vowel deletion, or emphasis. Lengthened nasal vowels present an orthographic problem in that doubling a <Vn> sequence could look like a disyllabic /VNVN/ sequence. Hence the standard orthography states that a hyphen should be inserted between the nasal vowels, so that long nasal vowels are written as <Vn-Vn>, as in [má:riùú] <márùn-ún> *five*, although in practice, not many writers use the hyphen for this purpose.

1.6.1 Processes affecting segments

Four main phonological processes affect consonants and vowels: vowel harmony, vowel assimilation, vowel deletion, and consonant deletion. These are discussed in turn below.

1.6.2 Vowel harmony

In Standard Yoruba, monomorphemic words show vowel harmony based on the feature +/-ATR, but only the half-close and half-open vowels are fully involved in the harmony. Thus any sequence of half-close or half-open vowels must agree in ATR value. Close vowels do not participate in vowel harmony and so can occur preceding or following any other vowel. The open vowel /a/ is -ATR and can only be preceded by a -ATR mid vowel, thus making the sequences /*eCa, *oCa/ impossible (Akinlabi, 2004, pp. 461–462; Archangeli & Pulleyblank, 1993, p. 13). The orthography represents vowel harmony transparently.

1.6.3 Vowel assimilation

Vowel assimilation optionally occurs in fluent speech when two vowels become adjacent, e.g. through reduplication or consonant deletion (Akinlabi, 2004, pp. 463–464). Generally, the first vowel completely assimilates to the second, but if the latter is close, then it assimilates to the first vowel; if the first vowel is close, then no assimilation occurs. In these cases, the tone of the assimilated vowel remains, often producing a contour tone on the long vowel. The orthography represents the unassimilated forms, keeping a consistent word image. Vowel assimilation is illustrated by the following associative constructions (2).

- (2) a. /ōwó ādéd/ → [ōwáādéd] <owó Adé> *Ade's money*
 b. /ōwó ēkṗṑ/ → [ōwéékṗṑ] <owó epo> *oil money*
 c. /ōwó iléd/ → [ōwóóléd] <owó ilé> *house money (i.e. rent)*

It should be noted however, that with more common N+N combinations, one of the vowels is deleted rather than assimilated (see pp. 114–115), although even then, the tone of the deleted vowel typically still remains, sometimes producing a contour tone on a single vowel.

One exceptional case of vowel assimilation is the negative marker /ò/ which assimilates fully to the preceding vowel or nasal consonant. Another exceptional case, illustrated below, is a process which reduplicates the initial VCV of a noun to form a noun meaning *all/every X* (3).

- (3) a. /ḥsè-ḥsè/ → [ḥsḥḥsè] <ḥsḥ ḥsḥ> *every week*
 b. /ḥsḥ-ḥsḥ/ → [ḥsḥḥsḥ] <ḥsḥsḥán> *every afternoon*

In this case, the tone of the initial vowel spreads leftwards to the assimilated vowel.

1.6.4 Vowel deletion

In vowel deletion, one of two adjacent vowel segments is deleted, rather than assimilated, with the only trace of its presence being its tone (Akinlabi, 2001, p. 838; 2004, pp. 464–466). The primary environment for vowel deletion is in V+N sequences, in which a /CV#VCV/ sequence produces /CVCV/. The standard orthography represents the undeleted forms (4).¹⁴

- (4) a. /kà iwé/ → [kàwé] <kà iwé> *be educated*
 read book
 b. /ḍḥē ōwó/ → [ḍḥēwó] <jḥ owó> *owe*
 eat money

In V+N sequences, it is not always predictable which vowel gets deleted (5), despite attempts at generalizations (Seidl, 2000, p. 280).

- (5) a. /rà êkpō/ → [rêkpō] <rà epo> *buy oil*
 b. /lá êkpō/ → [lâkpō] <lá epo> *lick oil*

This may be one reason why some V+N compounds are typically written in their contracted forms. However, the contraction of V+N sequences potentially results in increased ambiguity, since some forms which are different when written as two words would be identical when written as one word (6).

- (6) a. /rí ṵwò/ → [rṵwò] <rí ṵwò> *<rṵwò> *find a broom*
 b. /rí ḥwò/ → [rṵwò] <rí ḥwò> *<rṵwò> *find respect*

To remedy this, for V+N compounds that are usually written as one word, some writers (e.g. Ogunbọwale, 1970, p. 200) have used an apostrophe to indicate vowel deletion in which a L-tone has been displaced, so that /rí ḥwò/ *find respect* is written as <r'ṵwò>, although officially, this is not one of the cases where the apostrophe is permitted. The

14. Fákínlèdé (2016, pp. 49–52) lists 221 (mostly disyllabic) verbs that are derived from monosyllabic verbs and body-part nouns.

standard orthography does recommend making an orthographic distinction in cases where the final vowel of the noun would surface with a contour tone. In such cases, the final vowel is doubled, thus giving the following distinction (7).

- (7) a. /wá ìj'è/ → [wáj'è] <wáṣ'è> *look for a job*
 b. /wá ìj'è/ → [wáj'è] <wáṣ'è> *look for poverty*

Another common environment for vowel deletion is N+N sequences, in which a /VCV#VCV/ sequence produces a compound noun of /VCVCV/ structure. Most trisyllabic nouns are derived in this way (8).

- (8) /āyā obā/ → [āyābā] <ayaba ~ aya oba> *queen*
 wife king

1.6.5 Consonant deletion

Consonants are sometimes deleted between vowels word-internally (Akinlabi, 2004, pp. 466–467). For some words, the deleted consonant is not represented in the orthography, but for others, it is optionally included. Consonant deletion occurs in three main environments. The first is when the consonant is identical to a consonant in the following syllable (9).

- (9) a. /ēgúgú/ → [éégú ~ ēgúgú] <éégún ~ egúngún> *masquerade*
 b. /āgōgō/ → [āāgō ~ āgōgō] <aago ~ agogo> *watch / bell*

The second context is when the approximants /y/ or /w/ occur before their corresponding front or back vowels (10).

- (10) a. /lówólówó/ → [lólóló ~ lówólówó] <lówólówó> *soon*
 b. /òwúrò/ → [àárò ~ òwúrò] <àárò ~ òwúrò> *morning*
 c. /ādiyē/ → [ādiē ~ ādiyē] <adiyē> *chicken*

The third context is when /r/ occurs between identical vowels, or adjacent to a close vowel (11).

- (11) a. /dāradārá/ → [dāādāā ~ dāradārá] <dāādāā ~ dāradārá> *good/well*
 b. /èrèkè/ → [èèkè ~ èrèkè] <èèkè ~ èrèkè> *cheek*

Another consonant which is sometimes deleted intervocalically is /h/, although it is usually included orthographically.

1.7 Tone

1.7.1 Generalities

In comparison with the other focal languages in our series of experiments, Yoruba tonal processes are extremely well documented. Yoruba has three discrete level tones, H, M and L, although M tone syllables have been analyzed as underlyingly toneless because the M tone tends to disappear when its host vowel is deleted, whereas H and L tone still surface in that condition (Akinlabi, 1985; Akinlabi & Liberman, 2000, pp. 33–35). However, Ajíbóyè, Déchaine, Gick, and Pulleyblank (2011, p. 1640) show that there are two phonetically distinct M tones which are derived in different ways (either lexically/morphologically or syntactically), suggesting that not all surface M tones are underlyingly toneless.

The three basic tones account for all lexical items, and no tonotactic restrictions occur on the distribution on tones within a word, apart from the fact that H tones are rare word-initially. They only occur on certain consonant-initial words (which usually reveal a hidden initial vowel in the genitive construction), and on certain vowel-initial words in which an initial M tone has assimilated to a following H tone from an elided syllable (12).

- (12) a. /egúgú/ → /ēégú/ → [éégú] <eégún ~ egúngún> *masquerade*
 b. /ōwó-ēwó/ → /ōwówō/ → /ōówō/ → [óówō] <óowo> *boil (n.)*

The surface realizations of H, M and L tones on the second syllable of disyllabic nouns varies slightly according to the following rules (Bamgboṣe, 1966b, p. 9; Laniran & Clements, 2003, p. 208).

- A H-L sequence surfaces as H-HL;
- A L-H sequence surfaces as L-LH;
- The M of a L-M sequence is slightly lower than the M of a M-M sequence;
- The L of a M-L sequence has a low falling tone.

Yoruba shows no evidence of floating tones in the lexicon (Pulleyblank, 1986, p. 194), although morphemes with a grammatical function may be purely tonal, such as the subject-marking H tone.

The following sections summarize the tone orthography (Section 1.7.2) and various tonal processes. Some processes are post-lexical, occurring whenever the relevant conditions are attained, and are not represented in the orthography (Section 1.7.3); others are lexical, being limited to certain syntactic environments, and may or may not be represented orthographically (Section 1.7.4).

1.7.2 Tone orthography

In the Yoruba orthography, tones are generally marked as if the word occurs in isolation rather than in context, and hence the tone orthography is morphophonemic rather than phonemic, reflecting the input to tonal processes rather than the output.

The current tone orthography is based on the guidelines recommended by the *Joint Consultative Committee on Education* (FME 1974). These can be summarized as follows (Bamgboṣe, n.d.).

1. The tilde, formerly marking contour tones on long vowels, should be abandoned, and a double vowel with tone marks on each vowel be used instead.
2. Except in cases mentioned in (3) below, tone marks should be used at the author's discretion to facilitate comprehension, with only high and low tones being marked, unless all the tones in a particular word are mid, in which case a macron should be used.
3. In dictionaries, poetry, dialectal transcriptions, and other special writings, all high and low tones should be marked and all mid tones left unmarked.
4. The tone on a syllabic nasal should be indicated, especially where it is likely to be confused with an "n" indicating nasality (e.g. /dù̀ndù́/ <dù̀ndù́> *fried yam* vs /dù̀dù́/ <dù̀dù́> *type of drum*).
5. Elided low tone syllables which give rise to a rising contour tone should be indicated by doubling the vowel of the syllable in which the resulting contour tone occurs (e.g. /ó wá ìjé/ [ó wájé] <ó wáṣṣé> *he looked for work* vs /ó wá ìjé/ [ó wáǰé] <ó wáṣṣé> (s)*he looked for poverty*).
6. Other cases where the elision of a low tone syllable could also lead to ambiguities (e.g. /òní-àwò/ [àláwò] <aláwo> *owner of a cult* vs /òní-àwò/ [àlâwò] <aláwo> *owner of a plate*) should not be marked, with the context hopefully being sufficient to determine the correct meaning.

Since rules 2 and 3 are rather hard to implement consistently, full tone marking has become the norm in all print publications, not just for specialist works such as dictionaries. Thus in such cases, Yoruba marks all H and L tones, with M tones left unmarked, except in the case of syllabic nasals. It must be noted however, that tone marking remains easily the most poorly understood aspect of the current orthography, with the majority of students struggling to mark the H and L tones correctly most of the time (cf. Fagbòrun, 1989, p. 91).¹⁵ Indeed, as (Olúmúyíwá, 2013, pp. 45–48) shows with numerous examples, a considerable lack of unity and consistency remains in many other aspects of the orthography (notably vowel

15. Simpson (1985, p. 139) notes that newsreaders on Yoruba radio and TV frequently read from handwritten, translated texts which bear few or no tone marks. Consequently, "there is hardly a news translation programme in which there is no hesitation or misreading at some point, owing apparently to the absence of tonal marks on difficult words".

length and word division) in media such as newspapers, novels, websites and film productions, with deviations from the standard orthography showing no sign of disappearing in the near future.

1.7.3 *Post-lexical tonal processes*

1.7.3.1 *Tone spreading*

In Yoruba, H and L tones spread onto the following L and H tones respectively, creating HL and LH contours (13).

- (13) a. /àlá/ → [àlá] <àlá> *dream*
 b. /íá.íà/ → [íá.íà] <ràrà> *elegy, dirge*

They do not spread onto adjacent M tones however, and M tones themselves never spread. Tone spreading operates before vowel deletion (14).

- (14) a. /'ó fẹ̀ igrá/ → [ófẹ̀grá] <ó fẹ̀ igrá> *he/she wants a calabash*
 b. /'ó fẹ̀ igrá/ → [ófẹ̀grǎ] <ó fẹ̀ igrá> *he/she wants a white eggplant*¹⁶

The second example above illustrates what Bamgboṣe (1966a) calls an “assimilated low tone”.¹⁷ Such contractions pose a potential problem for the orthography, since rising tones are generally not marked, although writers employ a variety of other strategies to indicate such distinctions.

1.7.3.2 *Downstep and downdrift*

Automatic downstep, in which successive H tones are lowered after intervening L tones, has been reported in Yoruba (Connell & Ladd, 1990, p. 6; Laniran, 1993; Laniran & Clements, 2003, p. 210). These studies also report downdrift, in which sequences of like tones gradually get lowered over the course of an utterance, independently of other tones.¹⁸

16. *Solanum melongena*; known in anglophone west Africa as “garden egg” and in francophone west Africa as “aubergine”.

17. Theoretically, one would expect an analogous problem with an assimilated H tone, although because the initial vowel in Yoruba nouns cannot normally bear a H tone, this situation never arises.

18. The fact that the downstep of H tones in mixed HL sequences is greater than the downdrift of H tones in all H sequences shows the distinction between automatic downstep and downdrift. The downdrift of L tones in mixed HL sequences on the other hand is roughly equivalent to the downdrift of L tones in all L sequences, suggesting that L tones are not downstepped like H tones. Furthermore, M tones do not trigger downstep, as H tones in mixed HM sequences show downdrift comparable to H tones in all H sequences. Nor do L tones downstep M tones, as sequences of M tones in ML sequences show downdrift comparable to M tones in all M sequences.

In addition, Laniran (1993) and (Laniran & Clements 1995, 2003, p. 228) report some anticipatory effects whereby speakers raise the level of the first H tone in an utterance to make extra pitch space available for subsequent downstepped H tones. They also find that speakers sometimes reset the level of H tones later in an utterance, up to three times in long sentences, to increase the available pitch space. Both downstep and downdrift implementation strategies can vary considerably according to speaker and context.

Utterance-final tones are frequently subject to increased lowering effects (La Velle, 1974) while H and M tones are often more stable (Connell & Ladd, 1990, p. 11).

1.7.3.3 *Upstep or H tone raising*

A tonal process with a similar effect to downstep is H tone raising (Akinlabi & Liberman, 1995; Connell & Ladd, 1990, p. 17; Laniran, 1993; Laniran & Clements, 2003, p. 232), in which a H tone is upstepped before a L tone. Indeed, in a HLH sequence, where the second H is slightly lower than the first, it can be difficult to know whether the second has been downstepped or the first has been upstepped, or whether both occur simultaneously. H tone raising has been shown to exist in Yoruba by comparing the pitch of H tones in mixed HL sequences with the pitch of H tones in sequences consisting solely of H tones. The fact that H tones in mixed HL sequences are generally higher than H tones in all H sequences suggests that H raising exists.¹⁹

1.7.3.4 *H and L tone assimilation*

H tone assimilation is a process whereby, in a sequence of H tones following a L tone, the first and sometimes the second H tone will be slightly lowered compared to subsequent H tones. Similarly, L tone assimilation is a process whereby, in a sequence of L tones following a H tone, the first few L tones will be slightly raised compared to subsequent L tones (Laniran & Clements, 2003, pp. 230–241).

1.7.3.5 *Tone and consonant interaction*

A few studies have also noted the interaction between segments and tones. Both Hombert (1977, pp. 176–178) and Laniran & Clements (2003, p. 208) find that voiced and voiceless stops affect the pitch of the first 40–60ms of the following

19. It may appear counterintuitive that a H tone can be simultaneously downstepped and raised/upstepped, as the second H tone in a HLHL sequence will be downstepped because of the preceding HL sequence, and raised because of the following L tone. However, this is precisely what Laniran and Clements (2003, p. 232) report to be the case, since the second H tone in a HLHL sequence is higher than the second H tone in a HLHM sequence, which would trigger downstep but not upstep of the second H tone. They suggest that the function of having both downstep and upstep is to prevent downstepped H tones from crossing into the frequency band reserved for M tones, allowing H tones to be distinguished from M tones throughout an utterance.

vowel, with voiced stops lowering the initial section of following H tones and voiceless stops raising the initial section of following L tones. M tones are affected to a lesser degree.

1.7.4 Lexical tonal processes

1.7.4.1 Subject-marking H tone

A tonal morpheme consisting of a H tone clitic occurs at the end of all subject noun phrases (15; based on Akinlabi & Liberman, 2000).

- (15) a. /ṣmṣ ʼlṣ/ → [ṣmṣ lṣ] <ṣmṣ lṣ> *the child went*
 b. /ṣmṣ ɔ̀kùṣí ʼlṣ/ → [ṣmṣ ɔ̀kùṣí lṣ] <ṣmṣ ɔ̀kùṣí lṣ> *the male child went*

If the subject noun phrase ends with a HM tone pattern, the H tone clitic attaches to, rather than displaces, the M tone, resulting in a MH contour tone on the last syllable of the noun phrase. In both cases, the tonal morpheme is under-represented in the orthography (16).

- (16) a. /ɛ̀léṣ ʼlṣ/ → [ɛ̀léṣ lṣ] <ɛ̀léṣan lṣ> *the meat-seller went*
 b. /ṣmólé ʼlṣ/ → [ṣmólé lṣ] <ṣmólé lṣ> *Ọmólé went*

1.7.4.2 L tone raising at phrasal boundaries

Monosyllabic verbs with a L tone in isolation have a M tone when followed by a full noun (17; based on Awobuluyi, 1979, p. 156).

- (17) a. /mō m̀/ → [mō m̀] <mo m̀> *I know*
 b. /mō m̀ ib̀è/ → [mō m̀ ib̀è] <mo m̀ ib̀è> *I know the place*

1.7.4.3 L tone raising in the associative construction

A possessum with a final L tone takes a final M tone when followed by a possessor with an initial M tone (18; based on Awobuluyi, 1979, p. 156).

- (18) a. /ɛ̀wù āỳ/ → [ɛ̀wù āỳ] <ɛ̀wù Aỳ> *Ayo's shirt*
 b. /bàtà āỳ/ → [bàtà āỳ] <bàtà Aỳ> *Ayo's shoes*

Possessors that begin with a consonant behave similarly, even if they have an initial H tone (19).

- (19) a. /gèlè yétúdí/ → [gèlè yétúdí] <gèlè Yétúdí> *Yetunde's head-tie*
 b. /ālùk̀p̀ùk̀p̀ù bólá/ → [ālùk̀p̀ùk̀p̀ù bólá] <alùp̀ùp̀ù Bólá> *Bola's motor cycle*

This suggests that nouns that appear to begin with a consonant actually begin with a “silent vowel” that carries a M tone. The vowel in question surfaces in possessive constructions in some dialects, when the preceding noun ends with a M or H tone (20).

(20) /iwé dàdà/ → [iwé ēdàdà] <iwé Dàda> *Dada's book*

Furthermore, the derivations of some consonant-initial names suggest an original initial vowel which has conventionally been dropped (e.g. Yétúndé <Īyé tú dé). This process is not represented in the orthography.

1.7.4.4 HL simplification

In the indefinite determiner construction (Noun-kí-Noun), a HL sequence is simplified to a M tone. The orthography represents the surface form (21; based on Ajíbóyè et al., 2011, p. 1637).

(21) a. /èrò-kí-èrò/ → [èròkērò] <èròkerò> *any kind of thought*
 b. /èwà-kí-èwà/ → [èwàkēwà] <èwàkewà> *any beans*

1.7.4.5 Object pronoun dissimilation

The 3rd person singular object pronoun is expressed by repeating the last vowel of the preceding verb. The pronoun has a H tone if the last vowel of the verb has a L or M tone, but a M tone if the last vowel carries a H tone. This could be considered a type of dissimilation (22).

(22) a. /mú ú/ → [mú ū] <mú u> *take it*
 /kó ó/ → [kó ō] <kó o> *pack it*
 b. /mū ú/ → [mū ú] <mu ú> *drink it*
 /ḍḗ ē é/ → [ḍḗ ē é] <jẹ é> *eat it*
 c. /mò ́/ → [mò ́] <mò ọn> *know it/him/her*
 /tò ó/ → [tò ó] <tò ó> *arrange it*

1.7.5 Lexical tone

With three tones and a fairly limited phonological inventory and syllable structure, together with the fact that the majority of noun and verb roots are monosyllabic, the functional load of tone in the lexicon is fairly heavy, with the number of minimal contrasts numbering in the hundreds. Akinlabi & Liberman (2000, p. 33) give the following examples of monosyllabic and disyllabic tonal minimal pairs (23).

(23) a. H /ŕá/ <ŕá> *to disappear*
 M /ŕā/ <rā> *to rub*
 L /r̀à/ <r̀à> *to buy*
 b. MH /ḥḱó/ <ọḱọ> *hoe*
 MM /ḥḱō/ <ọḱọ> *husband*
 ML /ḥk̀ò/ <ọk̀ọ> *car/vehicle*

Fagbörün (1989, p. 76) lists a tonal minimal quintuplet (24).

- | | | | | |
|------|----|--------|--------|----------------------|
| (24) | ML | /ìgbà/ | <ìgbà> | <i>climbing rope</i> |
| | MM | /ìgbā/ | <ìgba> | <i>two hundred</i> |
| | MH | /ìgbá/ | <ìgbá> | <i>calabash</i> |
| | LL | /ìgbà/ | <ìgbà> | <i>time</i> |
| | LH | /ìgbá/ | <ìgbá> | <i>garden egg</i> |

Ogunbòwale (1970, pp. 181–188) lists over 50 such minimal tonal contrasts, including 14 minimal pairs, 20 minimal triplets, 10 minimal quadruplets, and 6 minimal quintuplets, most of which are either all nouns or all verbs. Délàndò's (1969) dictionary of monosyllabic verbs lists scores of others.

1.7.6 Grammatical tone

Grammatical tonal contrasts are far more limited than lexical tonal contrasts. In fact the only known examples are in the difference between various pronouns. For the subject pronouns, the 2nd person singular takes a M tone, while the 3rd person singular takes a H tone (25; based on Awobuluyi, 1979, p. 22).

- | | | | | |
|------|----|--------|----------|----------------------|
| (25) | a. | /ṣ lṣ/ | <ṣ lṣ> | <i>you (sg) went</i> |
| | b. | /ṣ lṣ/ | <ṣ̣ lṣ̣> | <i>he/she went</i> |

For possessive pronouns, the 2nd person singular carries a LM tone pattern, while the 3rd person singular takes a ML pattern; in both cases the initial vowel of the pronoun assimilates to the last vowel of the noun (26; based on Akinlabi & Liberman, 2000, p. 45).

- | | | | | |
|------|----|------------|------------|-----------------------|
| (26) | a. | /īwé è.ɪē/ | <iwé rẹ̣> | <i>your (sg) book</i> |
| | b. | /īwé ē.ɪè/ | <iwé rẹ̣̣> | <i>his/her book</i> |

For object pronouns, the 2nd person singular is either /o/ or /e/ depending on dialect (although <ṣ> is usually preferred in writing), while the 3rd person singular is a copy of the final vowel of the verb (27; based on Bamgboṣe, 1967, p. 10).

- | | | | | |
|------|----|-------------|-----------|--------------------------|
| (27) | a. | /mō k̄pā ṣ/ | <mo pa ṣ> | <i>I killed you (sg)</i> |
| | b. | /mō k̄pā á/ | <mo pa á> | <i>I killed him/her</i> |

Verbs ending in /ṣ/ create a potential ambiguity between the 2nd and 3rd person singular object pronouns, although Abraham (1958, p. xii) notes a phonetic distinction between the two, in that the 2nd person singular form involves a long vowel with a rising contour in an “uninterrupted sweep” (28a), whereas the 3rd person singular form involves a series of two vowels each with their own distinct tone (28b).

- (28) a. /mō yṓ s̄/ → [mō yṓ:] <mo yọ́ ọ́> *I saved you (sg)*
 b. /mō yṓ s̄/ → [mō yṓ s̄] <mo yọ́ ọ́> *I saved him/her*

This distinction is not marked in the standard orthography, although some writers mark it by using a hyphen before the 2nd person singular pronoun (e.g. Rowlands, 1969, p. 19). The standard orthography does however suggest making a distinction when the verb ends in a nasal vowel, by placing an <n> after the pronoun in the 3rd person singular (29a), but not in the 2nd person singular (29b) (based on Bamgboṣe, n.d., p. 46). The reason for such a distinction only in this case is unclear.

- (29) a. /mō m̀ s̄/ → [mō m̄ s̄] <mo m̀ ọ́n> *I know him/her*
 b. /mō m̀ s̄/ → [mō m̄ s̄] <mo m̀ ọ́> *I know you (sg)*

2. Literacy background

2.1 Literacy programs

Yoruba literacy was introduced into the formal school system by Christian missionaries in the 1830s and continued until the *Gold Coast Legislative Council's Education Ordinance* of 1882, which excluded Yoruba from the subjects that could be taught. The missionaries objected strongly, but despite a few concessions regarding the use of Yoruba in infant schools, English remained the language of instruction and education until the 1920s, when the colonial language policy was reversed. By the 1940s, instruction occurred widely in both English and Yoruba, and by the time of independence in 1960, serious efforts were being made to encourage the study of Nigerian languages up to graduate level.

Today, throughout the Yoruba territory in Nigeria, Yoruba is used as the language of instruction during the first three years of primary school, and then as a required subject until secondary school. In Yoruba classes, it is used as the language of instruction up to graduate level, and graduates write their work in Yoruba. Yoruba was declared the official language for the southwestern part of Nigeria in 1977, and has been recognized as a medium of expression in the State and National Assemblies since 1979.²⁰

20. In Benin, the development of Yoruba literacy is much more recent. A set of Yoruba primers was published by the *Direction de l'Alphabétisation et de la Presse Rurale* in 1975, and revised in 1993 after the government selected Yoruba, along with five other languages for use in large-scale non-formal adult education programs (Kluge, 2011, p. 10). Some of the materials produced in Nigeria (e.g. the 1960 Yoruba Bible) are also available and in wide use in Benin.

2.2 Literature production

The first major works which laid the foundation for the establishment of Roman script Yoruba were Crowther's dictionary (1843; revised 1852a), primer (1849) and grammar (1852b). The first Yoruba newspaper appeared in 1859, but ceased publication in 1867, after which there were few new publications until the 1920s, when the first Yoruba novels started appearing. Yoruba literary output then increased steadily until the outbreak of the Nigerian Civil War (1967), with the publication of dozens of books in various genres, particularly poetry and folk narratives, and even adaptations of some Latin and Greek classical works. The last 20 years have seen the launch of at least 25 new Yoruba newspapers, although most of them have had rather short lifespans, to the extent that only one newspaper and three magazines are still in print today. Demand for Yoruba literature is now sharply falling and few publishing houses are willing to print books in Yoruba other than those that are on the approved reading lists for school or university examinations. The recent decline of Yoruba print media is a result of many factors, including lack of advertisements, poor financing, preference for English print media, poor reading culture, and a lack of coverage of local and current events (Olúnládé, 2016, p. 223). However, Yoruba texts online appear to be increasing, with the Yoruba Wikipedia site currently hosting over 33,000 articles,²¹ the African Storybook website offering 15 Yoruba books,²² and the BBC launching its own Yoruba service in 2018.

2.3 Pedagogical materials

2.3.1 *Primer*

Yoruba is unique among the focal languages in having been used fairly consistently as a language of instruction in primary schools in Nigeria for well over half a century (Awoniyi, 1976, p. 39; Roy-Campbell, 2003, p. 96). The main Yoruba primers used in primary and secondary schools today are a series called *Aláwíyẹ́* (Qúnjò, 2001, 2008a, 2008b), first published in 1949.²³ Here, we will examine the first volume of this series.²⁴ It is the only one among the focal language primers not based on the Gudschinsky method (Lee, 1982), and is also the only one aimed at

21. https://yo.wikipedia.org/wiki/Ojúewé_Àkókó (accessed 26 January 2021)

22. www.africanstorybook.org (accessed 29 March 2021).

23. More advanced students of Yoruba typically use any of the widely available grammatical sketches, such as Bamgboṣe (1967) or Awobuluyi (1979).

24. We have been unable to obtain permission to reproduce pages from this publication as we have done for the teaching materials in the other focal languages.

children rather than adults.²⁵ One sign of this is the abundant use of color drawings as illustrations, whether for phonemic awareness exercises, vowel/tone exercises, or stories. Additionally, teachers' notes are included at the bottom of many lessons, in blue ink and sometimes smaller font sizes. It is the most widely used of the numerous primers available.

The first three teaching pages, which are pre-lessons with drawings, are presumably used for teaching phonemic awareness. Following this, the letters of the alphabet are presented, each with four words under it in a 2x2 format. Most of the four words are disyllabic (with one exception) and have varying tone patterns. Eight words, however, have the same tone pattern; and only five include tonal minimal pairs, barring three near tonal minimal pairs. No systematic ordering of tone patterns is evident, so it is unclear whether the teacher is expected to draw attention to the tone pattern of each word at this stage or not.

The first five lessons consist of dialogues or stories. It appears that children are expected to memorize these texts as none of the letters have been taught yet, but teachers' notes are included with words that are perhaps meant to be copied or learned as sight words. Teaching of specific letters begins in lesson 6 with the vowels <o, ọ, a> /o, ɔ, a/. For lessons 6 and 7 a series of three drawings is presented in a box. In the lower right hand corner, the vowels that go with each word are presented with tone marks. At the end of lesson 8, a writing exercise of the fill-in-the-blank type is given. Three drawings with all but the final vowel of the word written underneath are presented; the child is expected to add the vowel with the appropriate tone mark. Lessons 9 and 10, teaching the nasalized vowel digraphs <in, un, ẹn, ọn> /ĩ, ɥ, ɛ, ɔ/, follow the same pattern as 6 and 7 except that lesson 10 ends with a sentence and an illustration. Lessons 11 and 12 are similar to lesson 8 except for requiring the student to fill in both vowels with tone marks. This seems to be the extent of lessons focusing on vowels and their tone.

From this point forward, children are taught the consonants using pictures and keywords, in syllables. The syllabic nasal and verbal particle <ń> /ń/ is used in the initial memorized lessons, and again in the stories for lessons 18–22. It is explicitly taught in lesson 26, where it is among the vocabulary/writing lesson words. On the other hand, the syllabic nasal <ñ> /ñ/ '1sg' is used in lesson 3, but never explicitly taught.

The pervasive elision of vowels across word boundaries affects the tone pattern of the resulting compound (Fagbørun, 1989, pp. 79–80). Although children would normally speak the elided forms, in this primer they are not taught elided written forms. The stability of word shapes is thus maintained, which is a plus in fluent

25. In Benin, the only Yoruba primers we are aware of are aimed at adults.

reading. This may be the reason the primer contains so many teacher-read stories, not only in the initial five lessons but in several later lessons as well, so that students learn to recognize the orthographic words by sight.

It is impossible to determine from looking at the primer if teachers are encouraging students to mark tones on vowels as they write or not. However, with the lack of explicit focus on tonal minimal pairs, and indeed of any exercises focusing on tonal awareness, in conjunction with the tonal processes due to unwritten elision, it seems unlikely that learners would be able to master accurately writing tone, even if they are able to accurately read texts.

2.3.2 *Transition Guide*

We have been unable to locate a transition guide for Yoruba, which is perhaps unsurprising as it has been taught in primary schools in Nigeria for decades, although we have not searched for such a publication in other countries where Yoruba is spoken.

Idaasha (*David Roberts, JeDene Reeder*)

1. Linguistic and orthographic background

1.1 Affiliation and location

Idaasha¹ is a language of the Ede continuum spoken in the Dassa-Zoumé and Glazoué communes of the Collines department of Benin (Figure 1). The Idaasha people migrated from Nigeria in the 17th or early 18th century (Baloubi, 2005, p. 17) and their language is very closely related to Yoruba and Ife. Eberhard et al. (2020) estimate a population of 180,000 in 2018.

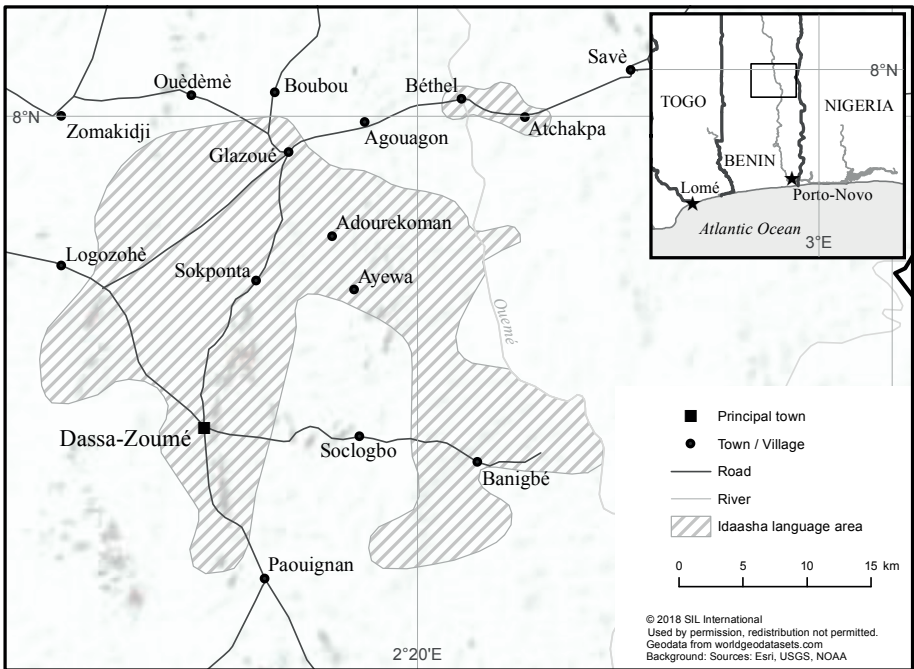


Figure 1. The Idaasha language area

1. ISO 639-3: idd. Glossonym and ethnonym (sg. and pl.): [idàáà] <Ìdàáshà>. Other spellings are < Idaasha, Idaaca, Idaasa, Idaatcha, Idaca, Idáítsà...>

Researchers differ in their identification of surrounding languages. According to Baloubi (2005, p. 9), the Idaasha territory is flanked on the south, west and north by speakers of Fon, Adja and Mahi, and on the east, by the vast Yorubaland spreading into Nigeria. Kluge (2011a, p. 3), on the other hand, identifies Cabe as being spoken to the north and north-east, Maxi to the north, west and south, and Southern Nago to the south.

Kluge (2011a, p. 12), reporting on a sociolinguistic survey undertaken in 1992–1993 in six Idaasha villages, found no distinct dialects and a high degree of internal comprehension. The only statement about Idaasha dialects we have found in the literature is a passing reference to the Kèré dialect (Baloubi, 2005, p. 75).² In fact, the title of Baloubi's work makes it clear that he considers Idaasha itself to be a dialect of Yoruba, rather than a language in its own right. One of the aims of Kluge's (2011a) survey was to investigate the relationship of Idaasha to both Yoruba and Ife, since in the early 1990s, when the survey was conducted, they were the only two Ede varieties to have already benefited from language development. It will be useful to summarize some of the major findings of Kluge's survey, while bearing in mind that the sociolinguistic realities may have changed in the intervening years.³

- *Lexical similarity*: A word-list analysis reveals 81.5% lexical similarity between Idaasha and Yoruba, and 92.2% between Idaasha and Ife. Kluge concludes that, from a linguistic point of view, Idaasha is not a different language from Yoruba or from Ife (p. 13).
- *Comprehension*: The average comprehension of a recorded narrative was 93% for Yoruba⁴ (p. 14) and 87% for Ife (p. 19). All participants reported passive understanding of Yoruba, and 88% claimed that they understood everything in Yoruba radio broadcasts (p. 17). Fewer participants (79%) reported that they understood all or most of what they heard when listening to Ife speakers (p. 20) in spite of the higher degree of lexical similarity.
- *Bilingualism*: In contrast to the comprehension results, only 40% of participants reported the ability to be able to say everything they might want to say in Yoruba (p. 17) and even fewer (25%) spoke Ife (p. 20). Half the participants reported ability to speak (50%) and understand (56%) French, the official language of Benin, with level of formal education being the predictive variable. 42% reported that their children speak French (p. 27).
- *Language use and vitality*: All participants reported almost exclusive use of Idaasha among family, and a majority (68%) among friends. However, a sizeable minority (32%), most of them younger people, reported speaking Yoruba

2. The sample in the Idaasha experiment is dialectically homogenous.

3. References to Idaasha are also scattered throughout the other seven volumes of this series.

4. The recorded narrative was of a Yoruba speaker from Porto-Novo, Benin.

with their friends. Only a few, all male, reported use of French, either with friends, at work, or on the farm (p. 22). All participants reported using Idaasha in the local markets, with the additional use of Yoruba by a minority (8%). 86% of participants reported using Idaasha in the regional market, while 16% use Yoruba and 22% (all of them educated males) use French in addition to or instead of Yoruba. In the offices of the subprefecture, 56% use Idaasha, 32% use French and 10% use Fon, in addition to or instead of Idaasha (p. 23). 61% of participants report using Idaasha when communicating with Yoruba speakers, compared with 84% when communicating with Ife speakers. (p. 23). Village-based children use Idaasha when playing with other children (p. 22). The report found no evidence of language shift (p. 24, 29).

- *Language attitudes*: All participants professed positive attitudes towards spoken Yoruba and Ife and a large majority expressed interest in being literate in these languages, particularly Yoruba (p. 25). Church representatives stated that their congregations would prefer to use Idaasha (p. 26). All participants reported positive attitudes about French as an international language (p. 27).

1.2 Orthography development

The earliest known attempts to write Idaasha can be traced to the initiative of an Idaasha Catholic priest, Nicolas Okioh in the 1970s. These early informal efforts tended to be influenced on the one hand by French (no tone was marked), and on the other by Yoruba (subscript pointing was used to indicate vowel quality). In the 1980s the Beninese government set up a *Commission linguistique idaasha* in tandem with similar commissions for other minority languages, whose role included orthography standardization. It held two seminars not long after its inception (CENALA, 1982, 1987). This commission remains the final authority on Idaasha orthography matters, though currently it is not particularly active. In addition, an association named IEI (Ìlòsíwájú Èdè Ìdàáshà, *Association for the Promotion of the Idaasha Language*) is engaged in language development.

Figure 2 shows a text written in the standard Idaasha orthography to show the visual effect of full tone marking.⁵

Lìrè kàn ́, isú gbo ajá gbó-o jí ija, shí àà jìjọ̀ rìn ògbà. Ó d'ọ̀jọ̀ kàn, shí ó kpinnu l'ínú wan, shí à ní àan ẹ̀ kó lo l'ígbò egi, shí àan kó kèè shole jògòròtán. À sè fùdá kòdò l'ílẹ̀ wan, shí à lo; yèè à tó l'ígbò egi ́, isú wí fí ajá ní: « Yèè n kékéré ̀yọ̀, shí ara úúm rẹ̀ rọ̀ra ́, wòm ní ẹ̀ kó gu egi ́ ẹ̀. Wọ̀yè, ẹ̀ sho gbé l'ídèdò líbíbí, shí bójí n ká ẹ̀so egi àan ́ kàn, ẹ̀ sho wà kó an dà lí àti. »

Figure 2. Idaasha written with full tone marking (Standard orthography)

5. For the origin of this text and a free English translation, see p. 30, footnote 8.

1.3 Previous research

The earliest mentions of *Idaasha* in the literature date back to the colonial period (Faroud, 1929; Hazoume, 1929; Maga, 1906) while much of the more recent research has tended to focus on Ede dialectology (Igué et al., 1993; Kluge, 2007, 2011a, 2011b; Parrinder, 1947; Rowbory, 2008). The *Commission Linguistique Idaasha* has researched anthroponymy, toponymy (CENALA, 1982, pp. 37–47) and code-switching (CENALA, 1982, pp. 48–53). Others have turned their attention to syntax (Kouyomou, 1991b), discourse analysis (Baloubi, 2000), proverbs (Tossou, 1973), phonology (Kouyomou, 1986), and tone (Baloubi, 1998).⁶ Most of the summary that follows is based on Baloubi (2005), which is the most extensive phonological description to date.

1.4 Typology

Idaasha is a largely isolating language with SVO word order. Syllable structure is limited to V, CV, CVV and CVN. *Idaasha* has deverbal prefixation, a restricted vowel harmony system and pervasive vowel contraction.

1.5 Consonants

1.5.1 Consonant inventory

Idaasha consonants are the same as those of Yoruba (see p. 111), except that the labio-velar stop /kʰ/ is written <kp> instead of <p>, and the palatal fricative /j/ is written <sh> instead of <ɕ> (IEI, 2012, p. 27).⁷ Baloubi (2005, p. 41, 65, 66) identifies the latter phoneme as a palatal stop /c/, but in fact it varies in pronunciation [c ~ tʃ ~ ʃ] which partly accounts for the multiple popular spellings of the language name (Rowbory, 2008, pp. 3–4).

1.5.2 Palatal approximant

The palatal approximant /y/ is pronounced [y] before an oral vowel (1a) and [ɲ] before a nasal vowel (1b). It is written invariably as <y> (based on IEI, 2012, p. 28).

| | | | | |
|--------|---------|-----------|---------|-----------|
| (1) a. | /āyā/ | → [āyā] | <aya> | wife |
| | /áyò/ | → [áyò] | <áyò> | garlic |
| | /āyéyé/ | → [āyéyé] | <ayéyé> | butterfly |

6. We have been unable to locate Baloubi's (1998) study of *Idaasha* and Yoruba tone.

7. The Yoruba central approximant /ɻ/ is transcribed as /r/ in this chapter as we have not been able to confirm its exact phonetic value in *Idaasha*.

- b. /èyĩ/ → [èɲĩ] <èyìn> *back*
 /òyĩ/ → [òɲĩ] <oyin> *honey*
 /òyúyò/ → [òɲúyò] <òyúnyòn> *brain*

1.5.3 Approximant elision

The approximant /w/ elides intervocalically before /o, u/ (2a, 2b) but not before /ɔ/ (2c). Similarly, /y/ elides intervocalically before /e, i/ (2d, 2e) but not before /ɛ/ (2f). The orthography maintains the approximants in all cases (based on Baloubi, 2005, pp. 46–49).

- (2) a. /èwò/ → [èò] <èwò> *nakedness*
 b. /èwú/ → [éú] <ewú> *greater cane rat*⁷
 c. /ɔwɔ/ → [ɔwɔ] <ɔwɔ> *hand*
 d. /iyē/ → [iē] <iye> *number*
 e. /àyì/ → [àì] <àyì> *intelligence*
 f. /ēyē/ → [ēyē] <eye> *bird*

1.5.4 Contrast between /m/ and /n/

Baloubi (2005, p. 61) provides minimal pairs to show the contrast between /m/ and /n/ (3).

- (3) a. /nù/ [nù] *be lost* /mù/ [mù] *to sink*
 b. /ní/ [ní] *say* /mí/ [mí] *breathe/stop*
 c. /ínú/ [ínú] *stomach* /ímú/ [ímú] *nose*
 d. /ànā/ [ànā] *in-law* /āmà/ [āmà] *clay*

He then goes on to explain that /m/ is realized homorganic to the place of the following consonant (2005, p. 62), illustrating this process with examples of the first person subject pronoun /m̩/. Baloubi considers the fact that it is a contraction of /wòmi → wòm̩ → m̩/ to be proof that it is underlyingly labial not alveolar (4), yet the orthography represents it with the grapheme <n> (based on IEI, 2012, p. 41).

- (4) a. /m̩ bɔ̃/ → [m̩ bɔ̃] <n̩ bɔ̃> *I came (back)*
 b. /m̩ nù/ → [n̩ nù] <n̩ nù> *I (am) lost*
 c. /m̩ kɔ̃/ → [ɲ̩ kɔ̃] <n̩ kɔ̃> *I refuse*
 d. /m̩ ɡbà/ → [ɲ̩m̩ɡbà] <n̩ ɡbà> *I accept/take*

8. *Thryonomys swinderiamus*. Known in anglophone west Africa as “grass-cutter” and in francophone west Africa as “aulocade” or “agouti”.

1.5.5 Contrast between /l/ and /n/

Kouyomou (1986) lists [n] as an allophone of /l/ preceding a nasal vowel. But Baloubi (2005, pp. 52–59) argues that they contrast. In Example (5) the vowels may optionally contract and, in doing so, a nasalized vowel loses its nasality (5b). If [n] was indeed an allophone of /l/, one would expect [l] to surface in the contracted non-nasalized forms, but it does not.⁹

- (5) a. [lí ìwé] ~ [lîwé] <lí ìwé> *have a book*
 [lí àwò] ~ [lâwò] <lí àwò> *have a plate*
 [lí ɔ̀k̀k̀] ~ [lɔ̀k̀k̀] <lí ɔ̀k̀k̀> *have a car*
 b. [ní ìwé] ~ [nîwé] <ní ìwé> *say a book*
 [ní àwò] ~ [nâwò] <ní àwò> *say a plate*
 [ní ɔ̀k̀k̀] ~ [nɔ̀k̀k̀] <ní ɔ̀k̀k̀> *say a car*

Consequently, according to Baloubi, the realizations of [n] before a nasal vowel in Examples (6a) and [l] before an oral vowel in Examples (6b) are not, as they appear at first sight, allophonic manifestations of /l/. Rather, the vowel itself is nasalized following /n/, and its underlying form is oral (based on Baloubi, 2005, p. 53).

- (6) a. /nú/ → [ɪnú] <ɪnú> *over there*
 /iná/ → [ɪná] <ɪná> *light, fire*
 /ó ní/ → [ó ní] <ó ní> *he/she says*
 b. /lú/ → [ɪlú] <ɪlú> *village*
 /ilá/ → [ɪlá] <ɪlá> *okra*
 /ó lí/ → [ó lí] <ó lí> *he/she has*

The graphemes <l, n> are both retained in the orthography.

1.6 Vowels

1.6.1 Vowel inventory

Idaasha vowels are the same as for Yoruba (see p. 112), but the orthography, following Beninese government policy (CENALA, 2011, pp. 3, 5), writes the mid –ATR vowels /ɛ, ɔ/ with special characters <ɛ, ɔ> rather than with subscript pointing (Baloubi, 2005, p. 36).¹⁰ Vowel length is contrastive. Long vowels are written by doubling them (IEI, 2012, p. 12). Diphthongs are also possible (IEI, 2012, p. 21).

1.6.2 Nasal vowels

Nasal vowels are written <Vn> following the French and Yoruba traditions, and again, in line with Beninese government recommendations for Ede languages

9. Our informant contests the existence of the contracted forms in Example (5).

10. Whenever Baloubi cites orthographic data, he uses Nigerian Yoruba conventions (2005, p. 11), spelling the phonemes /c, ɛ, ɔ/ with subscript pointing, i.e. <ɕ, ɛ̣, ɔ̣>, respectively (e.g. pp 48–49).

(CENALA, 2011, p. 4) (7a). Long nasal vowels (7b) and nasal diphthongs (7c) are written with a single postposed <n> (based on IEI, 2012, pp. 17, 21).

- (7) a. /it̃ā/ <itan> *story, history*
 b. /ɔ̃d̃ỹú/ <ɔ̃d̃ỹúún> *liver*
 c. /t̃íú/ <tíún> *very small, very few*

Vowels following /m/ and /n/ are usually nasalized (Baloubi, 2005, pp. 59–60), and because these are largely predictable they are not written (8; based on IEI, 2012, pp. 17–18; Okoumassoun, 1994, pp. 9–10).

- (8) a. /āmà/ <amà> *clay*
 b. /èmè/ <èmè> *bad joke*
 c. /īmú/ <imú> *nose*

However, Baloubi cites several examples in which vowels are not nasalized following /m/ (9).

- (9) a. /àmàlà/ <àmàlà> *leaf sauce*
 b. /méta/ <méta> *three*
 c. /àmòtí/ <àmòtí> *drunkard*

And, of course, the vowels /e, o/ can never be nasalized following a nasal consonant, because they have no nasal counterparts (10; Baloubi, 2005, pp. 53–54; and see also IEI, 2012, p. 17).

- (10) a. /āmèrè/ <amèrè> *twin*
 b. /òmòlò/ <òmòlò> *cucumber*

1.6.3 Vowel harmony

Idaasha has a limited ATR vowel harmony system in which vowels are divided into two sets: /i, u, e, o, a/ and /i, u, ε, ɔ, a/ (based on Baloubi, 2005, pp. 69–75). The close vowels /i, u/ participate in both sets, and can neither trigger nor be targeted by vowel harmony processes (cf. Archangeli & Pulleyblank, 1989, p. 176). The mid-vowels, in contrast, only co-occur within a word if they are in the same set, i.e. either /e, o/ or /ε, ɔ/. As for the open vowel /a/, it too participates in both sets, but with the additional constraint that it may never occur to the right of a +ATR vowel in the same word (e.g. */oCa/). When a prefix is added to a verb to form a deverbal, it obeys vowel harmony rules (for examples, see Baloubi, 2005, pp. 69–85). Vowel harmony is written transparently.

1.6.4 Vowel contraction

Vowel contraction across word boundaries is pervasive. It is usually the second vowel that is retained in pronunciation (11). The spelling of these forms is not yet stable; the contracted forms are sometimes permitted, but tend to be avoided if they generate ambiguities with other words (based on Baloubi, 2005, pp. 98, and see also 147–153).

- (11) a. /kū ōrī/ → [kōrī] <korin ~ kun orin> *sing a song*
 b. /k̄pū ōmī/ → [k̄pōmī] <kpun omin> *draw water*
 c. /jē ēwé/ → [jēwé] <jewé ~ je ewé> *eat leaves*
 d. /rā òwú/ → [ròwú] <ra òwú> *buy cotton*

Vowel contraction is particularly productive in compounds (12; based on Baloubi, 2005, pp. 114–115).

- (12) a. /l-bò-òjò/ → [ìbòjò] <ìbòjò> *waterproof material*
 PX-cover-rain
 b. /ā-kū-ōrī/ → [ākōrī] <akun orin ~ akorin> *singer*
 AGE-sing-song
 c. /ā-cē-ōnī/ → [ācēnī] <asheni> *one who undoes another*
 AGE-do-one/us
 d. /ā-dī-ētí/ → [ādētí] <adetí> *deaf person*
 AGE-block-ear

Similarly, the vowel and M tone of the possessive marker may elide if the possessum ends with a vowel (13; based on Baloubi, 2005, p. 123).

- (13) a. /ìjē tī kólá/ → [ìjē kólá] <ìje ti Kólá ~ ìje Kólá> *Kola's food*
 b. /ílé tī àmòní/ → [ílé àmòní] <ilé ti Àmòní ~ ilé Àmòní> *Amoni's house*
 c. /ìjē tī àmòní/ → [ìjē àmòní] <ìje ti Àmòní ~ ìje Àmòní>¹⁰ *Amoni's food*

Okoumassoun (1994, p. 9) and IEI (2012, p. 38) both recommend writing the non-contracted forms (14 a-c). The latter publication concedes that in some cases the contracted form is preferable, unfortunately without offering criteria by which to decide (14 d-f).¹²

- (14) a. /ōmā ēlélékó/ → [ōmēlélékó] <ōma élélékó> *<ōmeelélékó> *catechumen*
 b. /ōmā ērā/ → [ōmērā] <ōma eran> *<ōmeeran> *baby animal*
 c. /ōmā ēyē/ → [ōmēyē] <ōma eyē> *<ōmeeyē> *fledgling*
 d. /ōmā ānà/ → [ōmānà] *<ōma inà> <ōmanà> *sibling*
 e. /ā kò òcō/ → [àkòcō] *<à kò ashō> <àkòshō> *tailor*
 f. /ākó ìcē/ → [ākócé] *<a kó ishé> <akóshé> *apprentice*

11. Baloubi cites <ìje t' Àmòní>, but our informant contests the existence of this form.

12. IEI (2012, p. 36) refers to these, in French, as “amalgams” and spells most of them with long vowels. Baloubi (2005, pp. 147–153), on the other hand, refers to them, in English, as “contractions” and almost always represents them with short vowels in phonetic transcription.

1.7 Tone

1.7.1 Generalities

Both researchers who have studied the Idaasha tone system concur that it has three tones, H, M and L (Baloubi, 2005, pp. 86–99; Kouyomou, 1986, pp. 125–129). All vowels carry tone, as well as nasal consonants in pre-consonantal and word final position. In the orthography, H tone is written with an acute accent, L tone with a grave accent, and M tone with absence of an accent (IEI, 2012, p. 7). Idaasha has a restriction against disyllabic words beginning with a H tone, so of the nine possible tone patterns, only six actually occur: MH, MM, ML, LH, LM, LL (Baloubi, 2005, p. 90; Okoumassoun, 1994, p. 9).

1.7.2 Vowel contraction and tone

In cases of vowel contraction involving two dissimilar tones, various changes occur. If the two tones in question are H#L, they surface as a HL contour on the remaining short syllable, but since the vowel contraction is not written, the discrete tones are written too (15; based on Baloubi, 2005, p. 90).

- (15) /dá + èwù/ → [dèwù] <dá èwù> *purchase a shirt!*
 /kó + iwé/ → [kòwé] <kó iwé> *learn a book!*

However, HL is the only possible contour. L#H and M#H never occur because of the constraint against initial H on VCV words already mentioned. As for cases of vowel contraction involving H#M, M#L and L#M, the M tone is erased in favor of H or L, and it is these that are written in the orthography (16; based on Baloubi, 2005, pp. 114–115). Note also that, unlike Example (15) these forms are written as single orthographic words.

- (16) a. H#M /ì-bè-líicē/ → [ìbèlícé] <ìbèlìshé> *messenger*
 px-trust-with message
 b. HM#L /ā-kō-ìwé/ → [ākòwé] <akòwé> *educated person*
 AGE-write-letter
 c. HL#M /ì-dè-ìlél/ → [ìdèlé] <ìdèlé> *guarding*
 px-watch-house

1.7.3 Tonal polarity

The 1st person plural object pronoun /nī/ <ni> is invariably M tone, and the 2nd person plural object pronoun /yí/ is invariably H tone.¹³ But all the other object pronouns (1st, 2nd, 3rd sg. and 3rd pl.) receive their tones by a process of tonal polarity; they surface as M if preceded by H (17a) and as H otherwise (17b, 17c). The orthography represents the surface forms (based on Baloubi, 2005, pp. 92–93).

13. Our informant does not accept this transcription. He considers the 2nd person plural object pronoun to be MH [īí] <iín>.

- (17) a. H-M /ó rí m̄/ <ó rí um> *he/she saw me*
 /ó rí ē/ <ó rí ε> *he/she saw you (sg.)*
 /ó rí ū/ <ó rí u> *he/she saw him/her/it*
 /ó rí ā/ <ó rí an> *he/she saw them*
- b. M-H /ó k̄pā m̄/ <ó kpa úm> *he/she killed me*
 /ó k̄pā é/ <ó kpa é> *he/she killed you (sg.)*
 /ó k̄pā ú/ <ó kpa ú> *he/she killed him/her/it*
 /ó k̄pā á/ <ó kpa án> *he/she killed them*
- c. L-H /ó wò m̄/ <ó wò úm> *he/she looked at me*
 /ó wò é/ <ó wò é> *he/she looked at you (sg.)*
 /ó wò ú/ <ó wò ú> *he/she looked at him/her/it*
 /ó wò á/ <ó wò án> *he/she looked at them*

In the above examples, Baloubi (2005, pp. 92–93) lists the third person singular object pronoun invariably as /u/, presumably to economize on space, but elsewhere (2005, p. 77) he states that actually only speakers of the Kèré dialect pronounce it in this way and that it is normally pronounced as a copy of the preceding vowel, whether oral or nasal, resulting in multiple allomorphs (Baloubi, 2005, p. 75). In the orthography, the object pronoun is invariably spelled as <u> (18).

- (18) a. H-M /séú ~ séē/ <sé u> *close it*
 b. /fúú ~ fúū/ <fú u> *break it*
 c. M-H /tāú ~ tāá/ <ta ú> *play it*
 d. /jēú ~ jēé/ <jē ú> *eat it*
 e. L-H /kòú ~ kòó/ <kò ú> *sew it*

In the case of a word containing a nasal vowel, the nasality spreads onto the following vowel, but the object pronoun is not marked with a nasal vowel in the orthography (19).

- (19) a. /sāú ~ sāá/ <san ú> *pay it back*
 b. /cāú ~ cāá/ <shàn ú> *rinse it*
 c. /mìú ~ mìí/ <mì ú> *swallow it*

1.7.4 M and L verb tone alternation

The L tone of a verb becomes M before a M noun object (20; based on Baloubi, 2005, pp. 94–95).¹⁴

14. Baloubi (2005, p. 94) calls this process “M and L contrast and neutralization” but does not cite examples containing a H verb or a H tone object. According to him, the same process optionally affects L and M verbs before a L noun object (2005, pp. 95–97), and he refers to this as optional L tone spreading which is likely to occur in the same environment as vowel contraction. Our informant does not accept these forms.

- (20) a. /g̀b̀i/ <gbìn> *to plant*
 b. /ó g̀b̀ī icū/ <ó gbin ishu> *he/she planted a yam*
 c. /f̄s/ <f̄s> *to wash*
 d. /ó f̄s̄ āc̄s̄/ <ó f̄s̄ ash̄> *he/she washed clothes*

1.7.5 Possessive pronouns

The second person singular possessive pronoun is pronounced /è̄/ following H and M, and /ē/ following L. According to IEI (2012, p. 43) it is written invariably as <ε>, but our informant prefers <èε> following M (21).

- (21) a. /ilé è̄/ <ilé ε> *your house* (IEI, 2012, p. 43)
 b. /ījā è̄/ <ija ε> ~ <ija èε> *your friend*
 c. /bàtā ē/ <bàtā ε> *your shoe*

1.7.6 Lexical tone

The existing literature cites several cases of lexical tonal minimal pairs and triplets among nouns (e.g. 22);

- (22) a. /ījà/ <ijà> *fighting* (IEI, 2012, p. 7)
 /ījā/ <ija> *friend*
 b. /ṣ̀gb̄á/ <ṣ̀gbán> *craftiness* (Baloubi, 2005, p. 87)
 /ṣ̀gb̄à/ <ṣ̀gbàn> *thirty*
 /ṣ̀gb̄à/ <ṣ̀gbàn> *whip (n.)*

and several cases of lexical tonal minimal pairs among verbs (e.g. 23).

- (23) a. /rú/ <rú> *sprout* (Baloubi, 2005, pp. 87, 89)
 /rù/ <rù> *carry*
 b. /w̄s̄/ <w̄s̄> *pull, drag* (Baloubi, 2005, p. 95)
 /w̄s̄/ <w̄s̄> *enter, wear*

1.7.7 Grammatical tone

The existing literature contains the following examples of grammatical tonal minimal pairs (24).

- (24) /tè̄/ <tèε> *for you (sg.)* (IEI, 2012, p. 46)
 /tè̄/ <tè̄> *for him / her*

The following examples illustrate tonal minimal pairs in nominalization processes (25; Baloubi 2005, p. 115).

- (25) a. /àràkṗàtà/ <àràkpatà> *buying and slaughtering for sale*
 /āràkṗàtà/ <aràkpatà> *one who buys and slaughters for sale*
- b. /àràtà/ <àràtà> *retail produce*
 /āràtà/ <aràtà> *retailer*

2. Literacy background

2.1 Literacy programs

According to Baloubi (2005, p. 26), French missionaries did “minor literacy work” and made various attempts to initiate adult literacy in the 1970s (e.g. SPAPR-Zou, n.d.). But, as Kluge (2011a, p. 4) explains, it was only in 1986 that literacy began in earnest, when the Beninese government and UNESCO organized a seminar in Dassa to train Beninese participants in adult literacy (DAPR, 1986).

Following this, an *Idaasha* literacy program was started, and by 1993 it had spread over the whole language area, even though *Idaasha* was not among the six languages that the Beninese government had chosen for promotion in non-formal education in the previous year. Kluge (2011a, p. 4) notes high levels of enthusiasm for *Idaasha* literacy. 42% of participants in her survey reported having tried to write *Idaasha*, mostly better-educated men (p. 28). Kluge also reports the presence of ongoing literacy classes in almost every village surveyed: six times a week in the dry season and once a week in the rainy season. Eberhard et al. (2020) state that *Idaasha* has been taught in primary schools in a small-scale multilingual education program since 2014 and estimate a literacy rate of 20%. Literacy efforts have benefitted from involvement of foreign NGOs such as *Coopération Suisse*. These have tended to place an emphasis on literacy and numeracy for agricultural development, focusing in particular on cotton production.

Table 1 reports the enrolment and success rates of the government’s *Idaasha* literacy program in the Collines department for the decade 2006–2015. The difference between the “enrolled” and “tested” figures is primarily due to abandonment.¹⁵

15. The government literacy program, which covers the Zou and Collines departments, offers classes in both *Idaasha* and *Fon* (the vehicular language in the south of Benin) and it is common for people to enrol for both. Curiously, the figures in the annual reports do not distinguish between the two languages. Those in Table 1 are for the *Idaasha* classes only, based on discussions with André Eteka, the program co-ordinator.

Table 1. Enrolments and graduations in the government-based *Idaasha* literacy program

| | Level 1 (Primer) | | | Level 2 (Post-literacy) | | |
|--------------|--------------------------|-------------|-------------|-------------------------|-------------|------------|
| | Enrolled | Tested | Passed | Enrolled | Tested | Passed |
| 2006 | 395 | 280 | 265 | 347 | 221 | 204 |
| 2007 | 617 | 440 | 406 | 231 | 157 | 141 |
| 2008 | 363 | 281 | 268 | – | – | – |
| 2009 | <i>data unobtainable</i> | | | | | |
| 2010 | 393 | 303 | 277 | 143 | 132 | 131 |
| 2011 | 268 | 247 | 237 | 249 | 176 | 171 |
| 2012 | <i>data unobtainable</i> | | | | | |
| 2013 | 363 | 312 | 308 | – | – | – |
| 2014 | 290 | 261 | 260 | – | – | – |
| 2015 | – | – | – | 354 | 332 | 331 |
| Total | 2689 | 2124 | 2021 | 1324 | 1018 | 978 |

On average, 96% of those who take the exams pass them, but only 79% of those who enroll in the course get as far as taking the exam, so the challenge for the organizers, as in most local language literacy programs, is to find ways of sustaining interest. Abandonment rates are higher in level 1 than in level 2, but exam success rates are more or less equal at both levels. The decline in literacy activities during the period 2013–2015, with only one level being taught each year, is due to government funding cuts.

2.2 Literature production

The earliest reported literature production is in the 1970s. According to Baloubi (2005, p. 26), publications from this era are limited to leaflets about local history, folktales, healthcare, and environmental issues. They were produced before the orthography was standardized by volunteers with no linguistics training.

The *Commission Linguistique Idaasha* held two seminars not long after its inception (CENALA, 1982, 1987), the first of which developed plans for a readers' guide and a primer. Since then numerous orthography guides have been published (Kouyomou, 1989, 1991a; Okoumassoun et al., 1994; SLI, 2001). Other publications include booklets about *Idaasha* history, forestry, farmers' insurance, simple math, family matters, AIDS, proverbs, folktales, songs, riddles, greetings, politeness formulas and names. A course using an experimental literacy strategy and various lexicons of specialist terminology have been developed. A newspaper entitled *Erokó gbó!* (Listen and talk about it!) was published sporadically in the 1980s. Some New Testament portions have been published, as well as a picture book of the life of Jesus based on the Gospel of Luke.

2.3 Pedagogical materials

2.3.1 *Primer*

Three Idaasha primers exist (DAPR, n.d.-a, n.d.-b, n.d.-c; MEPN, 2010; Okoumassoun, 1994), but it is the 1994 publication that is evaluated here, as it is presumed that many of the experiment participants would have learned using this primer. It has six pre-lessons teaching tone. Immediately after the first word in a pair, a boxed exercise helps the learner identify which of three words is identical to the word just introduced. A 3x3 array of these words is presented at the bottom of the page as an identification exercise. The primer also includes tone exercises in many of its lessons, including review lessons, using a drawing of an antelope horn to signal that learners should listen to the pitch of the words (Figure 3).

A major strength of this primer is that the teachers' notes at the front of the book include a section on the orthographic rules, with a focus both on tone and on syllabic nasals. Also, along with the tone drills, tone marks are included for writing exercises from the first lesson onwards. A further strength is that the syllabic nasal is the focus of lesson 12, although unfortunately it is not used in the subsequent review lesson.

2 mejì e

1 a e
la le

2 la
le

3 à lè è lè le é
àlè èlè leé

4 e èlè
E ÈLÈ

5 àlè lé
àlà là
èlè

6 è È

7 Ediye lé àlè.
Ajà lé àlè.
Lé àlè!

8 Ediye lé àlè.
Àlè Ediye le.
Ediye le.

9 àkprèkò

20 21

Figure 3. Idaasha lesson with tone indicated throughout the drills as well as a dedicated tone drill (Okoumassoun, 1994, pp. 20–21)

However, in the drills for the lessons, while the built words include tone markings on individual syllables as well as the entire word, the other non-tone drills (drills 1, 2 and 3) on the left-hand page of the lesson never include accents. This, and the lack of immediate reinforcement of the syllabic nasal, appear to be the only weaknesses of the primer as far as tone pedagogy is concerned.

2.3.2 Transition guide

The Idaasha transition guide (IEI, 2012) specifies that it can be used either in a class setting or for self-teaching. Tone is the subject of lesson 2, after the introduction of the alphabet. The importance of writing tone in Idaasha in order to distinguish between words is explained. A tonal minimal pair and triplet illustrate this point. The tone lesson also specifies that tone is found on every vowel as well as <n> and <m>. A list of words and a phrase illustrate this latter point. One reading and one writing (translation) exercise are given.

Tone is addressed in subsequent lessons as well. Learners are encouraged to remember to write accents on writing exercises. Lesson 5, which teaches vowel length, specifies that tones on double vowels may be identical or different, and must be written appropriately. Examples are given for each vowel (Figure 4).

Leçon 5 Les voyelles doubles

Il y a certains mots dont leur prononciation exige de leur orthographe des voyelles doubles avant que la phonétique ne soit conforme. Ces voyelles doubles peuvent porter les mêmes tons ou les tons différents. Dans certains cas, on a des voyelles triples.

Exemples :

| | | |
|----|--------|-------------------------|
| aa | tàátà | <i>mardi</i> |
| ii | òníí | <i>crocodile</i> |
| ɔɔ | dòòdɔɔ | <i>variété d'igname</i> |
| ee | téé | <i>très haut</i> |
| ɛɛ | fèè | <i>facilement</i> |
| oo | tóó | <i>calme absolu</i> |
| uu | tùùtùù | <i>barbe de maïs</i> |

Exercice de lecture :

Lí tàátà ́, Àlúlù kò ta d̀òòdɔ̀ è.

Àbáákú kò kó lɔ fùùù.

Bí ilè tutù àà wà ro oko fèè.

Ìtòò Àbárí fà lɔ lókè téé.

Figure 4. Double vowel lesson in the Idaasha transition guide (IEI 2012, 14)

Tone is addressed again in lesson 9, which is devoted to the nasal consonants. In this lesson, learners are reminded that when these consonants are syllabic, they carry tone; three sentences illustrate this point. The final section of the guide, lessons 21 through 27, briefly describes various grammatical aspects of *Idaasha*, many of which involve tone. Although the difference is not explicitly emphasized, the lessons on different parts of speech show that the 2sg and 3sg pronouns in several but not all forms are tonal minimal pairs. Tone also plays a role in negation, but only examples are given, not rules. Most of these lessons include at least one exercise.

The *Idaasha* transition guide does have a few weaknesses. First, lesson 1 has a writing exercise that requires students to use accents before tone is taught. Also, while the lack of drawings to confirm the meanings of tonal minimal pairs and triplets would not trouble the highly literate, they would help those whose French is weak. Another weakness is found in lesson 21, which discusses words that are combined in speech, the basic rule being that words should be written as pronounced in isolation. However, the authors note that five of these compounds have “sacrosanct” status and are written as pronounced. As none of the tone patterns of the phrase match those of the independent words, learners must memorize them or have highly developed tone awareness. Finally, it would be helpful to learners for the tonal distinction between grammatical words to be explicitly pointed out, with exercises that force them to correctly distinguish between tonal minimal pairs.

Ife (*David Roberts, JeDene Reeder*)

1. Linguistic and orthographic background

1.1 Affiliation and location

Ife¹ is a language of the Ede continuum (Capo, 1989),² spoken in a territory straddling the Togo-Benin border. In Togo, the Ife inhabit villages in the Ogoou and Est-Mono prefectures of the Plateaux Region. Their chief town, Atakpamé, is in Togo, at the western edge not only of the Ife territory, but also of the entire Ede continuum. In Benin, they inhabit villages in the western Savalou commune of the Collines department (Figure 1). Eberhard et al. (2020) citing Gblem-Poidi

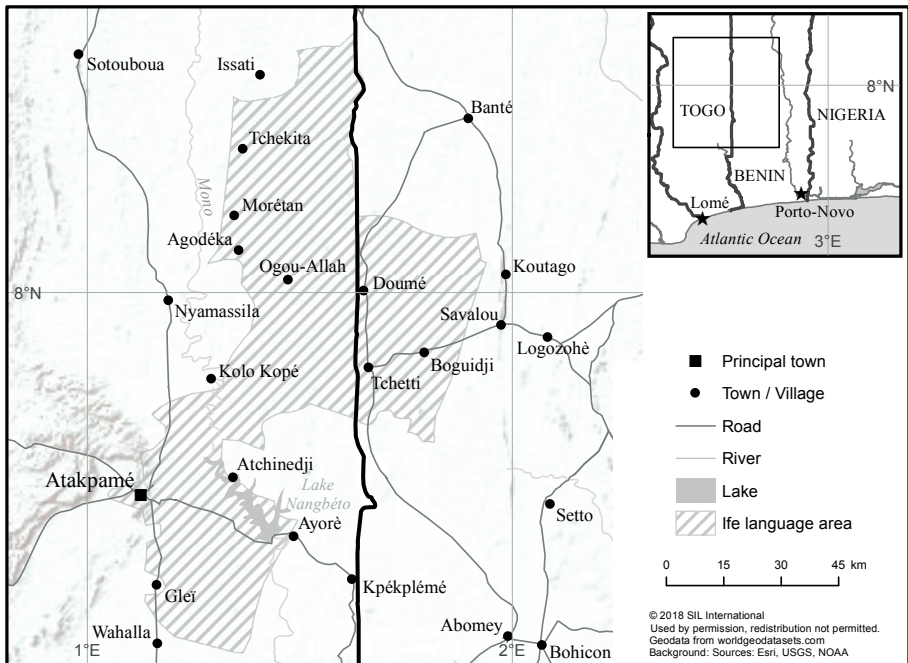


Figure 1. The Ife language area

1. ISO 639-3: ife. Glossonym and ethnonym (sg. and pl.): [ifè] <ifè>.
2. See Kluge (2007, 2011b) for further discussion of language classification in the Ede continuum.

and Kantchoa (2012) estimate the Ife population to be 127,000 in Togo and 179,600 worldwide.

According to Gonçalves (1984, p. 5), the Ife people emigrated from the Yoruba holy city of Ile-Ife (Nigeria) in about 1654 and settled in Benin, purportedly in the towns of Tchetti (Boëthius, 1981, pp. 1, 9) and Ìjà-Òkú (Fábùnmi, 2010, p. 33). From here, fleeing war with the Fon, they gradually moved into Togo.

Ife is known as Ana by outsiders (Gonçalves, 1984, p. 6) and this term is occasionally used by educated Ife when speaking French, the official language of Togo and Benin (Kluge, 2011b, p. 28). Ife is sometimes referred to as Baate in Benin (Boëthius, 1981, p. 1).

Boëthius (1981, p. 8) identifies three dialects: Nyanya, Djama and Gberioko.³ High levels of intercomprehension exist between all of them, but the Kamboli dialect is called “Cold Ife” by others (Gonçalves, 1984, p. 5) and Tchetti speakers make fun of Djama speakers because of their strong nasalization (Gonçalves, 1984, p. 32).

The Ife language is closely related to Yoruba and Idaasha, the two other Ede languages included in our series of experiments. Ife, especially in Benin, is often considered to be a member of the “Nago” language group (Reeder, 2017, p. 27). Kluge (2011a, p. 13) reports 73% lexical similarity with Yoruba of Porto-Novo and 88% with Idaasha. Fábùnmi (2010, p. 33) considers Togolese Ife to be a dialect of Yoruba rather than a distinct language.

Boëthius (1981, pp. 9–11) reports that, of the twenty lycée students she interviewed in Atakpamé, 21% claimed bilingualism in Yoruba, 58% in both Ewe and Mina, 90% in French and 13% in Tem. However, these figures should not be taken as being representative of the entire Ife population. Boëthius (1981, p. 9) reports many monolingual villages between the river Mono and the Benin border, and the social profile of the Ife sample in our series of experiments confirms that this is still the case.

1.2 Orthography development

In the early 1970s, when Togo participated in UNESCO’s *Experimental Program of World Literacy*, Ife was not one of the languages chosen by the government for promotion in non-formal education.⁴ However, it was considered acceptable to

3. Komi Sena (p. c.) does not recognize Nyanya and Gberioko as dialects, and instead lists Tchetti, Ilodji, Kamina, Doumè, Itcha, Séana, Datcha and Kamboli.

4. The languages chosen were Ewe, Kabiye, Tem and Moba (Afeli, 2003, pp. 6–7). The Beninese government’s language policy has traditionally been more overtly inclusive than that of the Togolese government, favoring the development of all languages spoken on Beninese territory as “national” languages.

do linguistic research in any language, so it was with this goal, and to develop the orthography, that SIL began to collaborate with Ife speakers in the early 1980s.

First, Boëthius (1981) undertook a sociolinguistic survey to find out if the Ife were sufficiently bilingual in Ewe or Yoruba to be able to use literature in either of these languages.⁵ This was followed by field trips to Kamina in the canton of Gberioko (Boëthius, 1982a) and Ile-Ife in Nigeria (Boëthius, 1982b). These helped to establish that Togolese Ife is fairly homogenous internally, and that it has little in common with the Yoruba variety spoken in Ile-Ife.

After some preliminary linguistic analysis, a tentative alphabet was developed. It was presented for the first time in 1982 at a meeting of twenty orthography stakeholders in Atakpamé. A provisional language committee took on the task of studying various aspects of the orthography in greater detail (Reeder, 2017, p. 19).

In 1984, a second stakeholders' meeting was held, again in Atakpamé, with a view to making definitive decisions about the Ife alphabet. About 100 people attended, including various political, traditional and religious leaders. Participants represented all the different regions in the Ife homeland. This meeting ratified the decisions taken at the preceding meeting and the work of the provisional committee. Delegates also elected the official *Comité de Langue Ifè*, composed of 22 members and unanimously chose Tchetti, the dialect spoken in Atakpamé, as the standard. Following this, draft teaching materials based on the new orthography were tested for a year among Baptist churches in the Est-Mono region, which was considered to be the dialect furthest from Tchetti. It was concluded that learners in this region had no difficulty learning to read the Tchetti standard (Gardner, 2003, p. 4).

The language committee continued its work until 1988, when it became dormant following the deaths of several key members, and has never been revived. However, in 2003, a further orthography conference was organized in Doumé, Benin, in direct response to the work of a lone literacy worker on that side of the border who was publishing materials in a version of the orthography that represented the local dialect and whose choice of letters favored transition to Yoruba (Reeder, 2017, pp. 19–20). A report defending the agreed standard was presented at this event (Gardner, 2003).

Figure 2 shows a text written in the standard Ife orthography to show the visual effect of full tone marking.⁶

5. SIL undertook a more extensive sociolinguistic survey of the Ede continuum a decade later (see p. 146).

6. For the origin of this text and a free English translation, see p. 30, footnote 8.

Ès5 òḡu adzà dídza, tsí ídza á dḡ́ fú ḡa tóbèè, à kà ye ara ḡa. À wà si, à wà si, tsí ó dḡ́ nódz5-kà, tsí à wáa mú arū dḡ́ ní àḡa kó ló nóko iḡtí, tsí àḡa kó ló káà tsolèé ká. Nḡèé, à òḡe nílé tsí ké àkḡò-kà bané. Kíbí à káà tó nóko-iḡtí é, ès5 wà wí fú adzà ní: Yèé òḡu kò lákú, tsí òḡu féré gbo é, òḡu náko gu egi é ló, tsí wà ká iḡtí dḡ́ wá nílé, tsí adzà òḡu kó wà nábé-è si, tsí kó wà seé dḡ́ náakḡò. Tsí adzà ní: Yoo ó sà.

Figure 2. Ife written with full tone marking (Standard orthography)

1.3 Previous research

Published linguistic research on Ife is still quite limited.⁷ It consists of two phonological sketches (Boëthius, 1983; Gonçalves, 1984), an Ife-French dictionary (Gardner & Graveling, 2000) and individual studies of mood (Boëthius, 1987), the discourse functions of two particles (Klaver, 1995, 1999), the tone system (Kohler, 1983), and vigesimal numerals (Fábùnmi, 2010). Three unpublished manuscripts provide a grammar sketch (Klaver, 1988), a study of vowel processes (Kohler, 1984b), and an investigation of how best to write tone (Boëthius, 1991).

References to Ife are also scattered throughout the eight volume series that reports on an international sociolinguistic survey whose aim was to investigate levels of mutual comprehension and bilingualism across the Ede continuum (the introductory volume is Kluge, 2011b). No single volume treats Ife alone because the survey focused on Ede varieties that were not already being developed.

1.4 Typology

Ife is a largely isolating language with SVO word order. TAM distinctions are expressed by one, two or three preverbal particles, though in Boëthius' database of 6,000 clauses, only about one in 25 contain any preverbal particles at all (Boëthius, 1987, p. 45). The morphophonology is characterized by ubiquitous vowel processes (Gonçalves, 1984, p. 6; Kohler, 1984b, p. 11). Gonçalves (1984, pp. 67–68) hints that there may be limited vowel harmony, but this awaits further investigation.

Syllable structure is V, CV, CVV and N; codas do not exist except, rarely, CVm in certain reduplicative ideophones (Gonçalves, 1984, p. 64). The onsetless syllable V is present only in prefixes, never in roots (Gonçalves, 1984, p. 10). In CVV syllables, the two adjacent vowels are always homogenous; there are no diphthongs (Gonçalves, 1984, p. 12). Most words are mono- or disyllabic. The citation form of most verbs is monosyllabic, though some CVCV verbs do exist (Klaver, 1988, p. 5). Almost all nouns with this structure are borrowed words (Klaver, 1988, p. 3).

7. A number of publications with the word “Ife” in the title actually treat the Ife dialect of Yoruba in Nigeria, not the Ife language spoken in Togo.

1.5 Consonants

Ife consonants are largely the same as those of Yoruba (see p. 111), but with the addition of the palatal and velar nasals /ɲ, ŋ/ <ny, ŋ>, and the labio-velar /kʰ/ being written <kp>, as in Idaasha, instead of <p>.⁸ In addition, the palatal series follow the spelling conventions of Ewe, the vehicular language of the south of Togo. Thus, /c/ is spelled <ts> (rather than French <tch>, or Nigerian Yoruba <ɕ>), and /j/ as <dz> (rather than French <dj> or Yoruba <j>) (Gardner, 2003, p. 1; Gonçalves, 1984, p. 64).

Gonçalves (1984, p. 64) does not include the phoneme /p/ in his consonant phoneme inventory presumably because it occurs only in borrowed words (e.g. <pómpì> [pómpì] *public water tap* and a few ideophones (e.g. <pém pém> [pém pém] *very white* (Gardner, 2003, p. 1).

Pre-consonantal nasals are pronounced homorganic to the following consonant, (Gonçalves, 1984, p. 65) but the spelling is variable because of vocalic elision (e.g. <nómbé> [nómbé] *today* vs <ńbè> [ní ɪbè ~ mbè] *over there*).

1.6 Vowels

1.6.1 Vowel inventory

Ife vowels are the same as those of Yoruba (see p. 112), but the orthography writes the mid –ATR vowels /ɛ, ɔ/ with special characters <ɛ, ɔ> as in Idaasha. Vowel length is contrastive, and length is written by doubling the vowel (Gonçalves, 1984, pp. 16–17, 36).

1.6.2 Nasal vowels

Following the 1984 orthography meeting, the language committee discussed how best to represent nasal vowels. First, they explored the possibility of following the French <Vn> convention, but decided against this because Ife already has words in which /n/ follows an oral vowel, e.g. [àntà] *<àntàn> *chair*. It was also considered preferable to avoid a sequence of two nasal graphemes in words such as [kàŋgí] *<kànŋgí> *tamtam*. Instead, the committee decided to write nasal vowels with a superscript tilde, so the above examples are spelled <àntã> and <kãŋgí> respectively (Gardner, 2003, p. 2). However, since all vowels are nasalized following nasal consonants, the committee judged that it was unnecessary to write a tilde in this context (cf. Gonçalves, 1984, pp. 32, 58–59). It is one of only two languages in Togo that writes nasals in this way (the other being Tamberma).

8. The Yoruba central approximant /ɹ/ is transcribed as /r/ in this chapter as we have not been able to confirm its exact phonetic value in Ife.

1.6.3 Vowel processes

As Kohler (1984b, p. 1) puts it, “With all morphemes ending with a vowel and most nouns beginning with a vowel, the condition for vowel processes to take place is frequently fulfilled in Ife”. However, she also notes that “it is quite difficult to set rules that are strictly kept across the whole language and by all its speakers”. She cites numerous authors who conclude that, in similar languages, these processes are variable rather than being absolutely predictable; that elided and non-elided forms may occur, even though one may be more common; and that the choice of pronunciation is often semantically driven.

Vowel processes occur most frequently between verbs or particles and the following nouns or pronouns. The process may concern vowel coalescence (1a), elision (1b), or labialization (1c; Kohler, 1984b, pp. 2–3). In all cases, the orthography represents the underlying form.⁹

- | | | | | |
|--------|-----------------|--------------------------------|------------------|----------------------------------|
| (1) a. | /ó gú àgù/ | → [ó gáàgù] | <ó gú àgù> | <i>he/she pounded fufu</i> |
| b. | /títí ilè má/ | → [títílè má] | <títí ilè má> | <i>until the morning</i> |
| c. | /òjò sã fú àyè/ | → [òjò sã f ^w áàyè] | <òdzò sã fú àyè> | <i>rain is good for life</i> |

However, in many cases, idiomatic phrases have become fully lexicalized as verbs (2; Kohler, 1984b, p. 13), and in these cases the orthography is variable.

- | | | | | |
|--------|------------|------------|-----------------|--|
| (2) a. | /k̂pē ārā/ | → [k̂pārā] | <kpara> | <i>to be wounded (lit. to beat body)</i> |
| b. | /né āyā/ | → [náyā] | <né aya ~ náya> | <i>to be married (lit. to have wife)</i> |

1.7 Tone

1.7.1 Generalities

Ife has three tones, H, M, and L. All vowels and syllabic nasals bear tone (Gonçalves, 1984, pp. 12–17). The participants at the 1982 orthography meeting made the decision to mark tone fully: H tone with an acute accent <◌́>, L tone with a grave accent <◌̀> and M tone with absence of an accent <◌> (Gardner, 2003, p. 4). As has already been noted, in cases where a nasal vowel takes either H or L tone, the accent is placed above the tilde <◌́̃, ◌̀̃>.

1.7.2 Vowel processes and tone

In cases of vowel processes, M is deleted along with its supporting segment following a H (3a) or preceding a L (3b; Kohler, 1984b, p. 4). In such cases, the orthography represents the underlying form.

9. The phonemic transcriptions of several of the published examples in this chapter have been modified to match our informant’s pronunciation of them.

- (3) a. /ó rí ēyē/ → [ó ríyē] <ó rí ēyē> *he/she saw a bird*
 b. /ó fā ìrù/ → [ó fàrù] <ó fā ìrù/> *he/she pulled the tail*

1.7.3 Tonal polarity

All the object pronouns surface as M after a H tone and H otherwise, except the 2nd person plural object pronoun which is invariably H (Table 1). The 2nd and 3rd person singular object pronouns are written joined to the verb (Kohler, 1984b, pp. 7, 14), and 3rd person singular is formed by doubling the vowel of the verb (Kohler, 1984b, p. 7).

Table 1. Tonal polarity on Ife object pronouns (based on Kohler, 1983, p. 155)

| <i>he/she refused X</i> | | <i>he/she beat X</i> | | <i>he/she joined X</i> | |
|-------------------------|---------------------|------------------------|---------------------|------------------------|--|
| 1sg | /s kò mí/ <ó kò mí> | /s k̄pā mí/ <ó kpa mí> | /ó bá mī/ <ó bá mi> | | |
| 2sg | /s kò é/ <ó kòé> | /s k̄pā é/ <ó kpaé> | /ó bá ē/ <ó báé> | | |
| 3sg | /s kò s/ <ó kòs> | /s k̄pā á/ <ó kpaá> | /ó bá ā/ <ó báa> | | |
| 1pl | /s kò wá/ <ó kò wá> | /s k̄pā wá/ <ó kpa wá> | /ó bá wā/ <ó bá wa> | | |
| 2pl | /s kò ñé/ <ó kò ñé> | /s k̄pā ñé/ <ó kpa ñé> | /ó bá ñé/ <ó bá ñé> | | |
| 3pl | /s kò ñá/ <ó kò ñá> | /s k̄pā ñá/ <ó kpa ñá> | /ó bá ñā/ <ó bá ña> | | |

If the 2nd person singular object pronoun follows a verb ending in /a/, this vowel changes to /ɛ/. Spelling practice varies between the surface and the underlying form (4).

- (4) a. /ó bá ē/ → [óbé ē] <ó báé ~ ó béé > *he/she caught up with you*
 b. /ó mà é/ → [ó mè é] <ó màé ~ ó mèé> *he/she knew you*
 c. /ó kpā é/ → [ó kpē é] <ó kpaé ~ ó kpēé> *he/she hit you*

1.7.4 Associative noun phrase

1.7.4.1 Noun of pronoun

The 1st singular, and 1st, 2nd and 3rd plural possessive pronouns are linked to the noun by a floating L tone. When the final TBU of the noun is H, the floating L tone associates to an extension of that segment which is unmarked in the orthography (5a); when it is L, the floating L tone merges with it (5b); and when it is M, the floating L tone replaces it (5c; Klaver, 1988, p. 11). These processes vary depending on the speed of speech. Possessive pronouns are always written joined to the noun with a hyphen.

- (5) a. /ílé + L + mī/ → [ilè̀mī] <ilé-mi> *my house*
 b. /àwù + L + mī/ → [àwùmī] <àwù-mi > *my dress*
 c. /bōbā + L + mī/ → [bōbàmī]⁹ <bobà-mi> *my father*

10. /bōbā̀mī/ is also acceptable.

1.7.4.2 *Noun of noun*

The associative noun phrase is marked by a floating M tone between the two nouns. It is realized on an extension of the final vowel of the first noun (6a, 6b). When this vowel is itself a M tone, the M tone associative marker merges with it so no extension is needed (6c). When the floating M tone associative marker follows a H and precedes an L it is deleted (6d; Kohler, 1984b, p. 6).¹¹

- (6) a. /ʔnà (M) l5mē/ → [ʔnàà l5mē] <ʔnà-Lome> *the Lomé road (lit. road of Lomé)*
 b. /lálá (M) bōbā/ → [láláà bōbā] <lalá-boba> *cow of father*
 c. /éwō (M) lálá/ → [éwō lálá] <éwō-lálá> *head of cow*
 d. /ʔkpá (M) iwé/ → [ʔkpáàwé] <ʔkpá-ìwé>~ <ʔkpáàwé> *pencil (lit. stick of paper)*

In the orthography, these are written hyphenated, sometimes with the addition of the M tone vowel extension where appropriate, except in cases where an associative noun phrase has been fully lexicalized. Again, spelling practice (conjunctive, disjunctive or hyphenated) is highly unstable (7; Kohler, 1984b, p. 14).

- (7) a. /5mā (M) ifē/ → [5māfē] <ɔma-ifē> *Ife person (lit. child of Ife)*
 b. /irē (M) nētí/ → [irētí] <irētí> *earring (lit. iron of ear)*

1.7.5 *Lexical tone*

The literature contains several cases of tonal minimal pairs (e.g. 8a), triplets (e.g. 8b) and even one quintuplet (8c) among nouns.

- (8) a. /ámí/ <ámí> *strength* (Gonçalves, 1984, p. 15)
 /àmì/ <àmì> *crack*
 b. /iré/ <iré> *race (sport)* (Kohler, 1984a, p. 4)
 /irē/ <irē> *prayer*
 /irē/ <ire> *happiness*
 c. /ōgú/ <ogú> *1. inheritance 2. twenty* (Gonçalves, 1984, p. 15)
 /ōgù/ <ogù> *spatula*
 /ògú/ <ògú> *hunting fetish*
 /ōgū/ <ogu> *war*
 /ògù/ <ògù> *talisman, charm*

As for verbs, since most of them are monosyllabic, tonal minimal triplets are common (e.g. 9).

11. The examples in Kohler (1984b: 6) in which the second noun begins with a M could be analyzed as being cases of regressive M tone spreading. The absence of this process when the second noun begins with a L tone would not be inconsistent with such an analysis, since M deletes before L. Unfortunately the author provides no examples in which the second noun begins with a H tone.

- (9) a. /d́í/ <d́í> *to block* (Kohler, 1984a, p. 10)
 /d̄í/ <d̄í> *to become*
 /d̀í/ <d̀í> *to tie up*
 b. /yá/ <yá> *to get bigger, to accelerate* (Gonçalves, 1984, p. 14)
 /yā/ <yā> *to rip*
 /yà/ <yà> *1. to exceed 2. to fork*

The bilingual Ife-French dictionary (Gardner & Graveling, 2000) is also a rich source of lexical tonal minimal contrasts too numerous to cite here.

1.7.6 Grammatical tone

Ife has several tonal minimal pairs and triplets among the subject pronouns and other grammatical particles (10; Boëthius, 1987, p. 45; Klaver, 1988, p. 18).

- (10) a. /n̄/ <n̄> *1 sg indicative SP*
 /n̄̄/ <n̄̄> *1 sg subjunctive SP*
 b. /ó/ <ó> *3 sg indicative SP*
 /ō/ <ō> *2 sg subjunctive SP*
 /ò/ <ò> *2 sg indicative SP*
 c. /è/ <è> *2 pl indicative SP*
 /ē/ <e> *2 pl subjunctive SP*
 d. /ká/ <ká> *1 & 3 pl subjunctive SP*
 /kà/ <kà> *negative habitual*
 e. /nàā/ <nàa> *2 sg SP + predictive marker*
 /náá/ <náa> *3 sg SP + habitual marker*
 f. /kàā/ <kàa> *2 sg negative predictive marker¹²*
 /kàá/ <kàa> *negative contrafactual marker*

2. Literacy background

2.1 Literacy programs

SIL initiated a literacy program in 1989, beginning in the Akparé zone, then expanding to the Est-Mono Prefecture, Doumé (Benin), Oké, Tchetti (Benin), Buko and Datcha-Glei (Reeder, 2017, pp. 24–30). The program placed a special emphasis on community solidarity, dealing with development issues such as the repairing of village pumps, reforestation, improving agricultural practices, and planning for retirement (Reeder, 2017, pp. 216–217).

Boëthius (1981, p. 9) reports that initial enthusiasm for the possibility of Ife literacy was “overwhelming”. Nevertheless, early literacy efforts encountered some

12. This form also serves the 1st person singular, but [kàkó] is also possible.

suspicion and resistance, sometimes to the point of physical violence (Reeder, 2013, p. 4), but over time, the literacy program has become an accepted part of community life. It is now run autonomously by ACATBLI (*l'Association Chrétienne pour l'Alphabétisation et la Traduction de la Bible en Langage Ifè*) an umbrella association covering six regional organizations (Reeder, 2017, pp. 28, 31–32). By 2004, well over 4000 Ife readers had graduated in Togo (Kluge, 2011b, p. 11). In the following year the program extended into Benin. Table 2 shows the combined graduation statistics for Togo and Benin in the decade since then.¹³ The marked increase in 2007 was due to funding that ACATBLI began to receive in that year from two Swedish organizations. Adult literacy in Ife is easily the most widespread and sustained in Togo, and more so than any other focal language in our series of experiments besides Yoruba.

Table 2. Graduations in the Ife literacy program

| | Level 1 | Level 2 | Level 3 (Ife to French transition) | French to Ife transition |
|--------------|--------------|-------------|------------------------------------|--------------------------|
| 2006 | 580 | 138 | – | – |
| 2007 | 1842 | 487 | – | – |
| 2008 | 1604 | 668 | – | – |
| 2009 | 3343 | 1058 | 656 | – |
| 2010 | 2645 | 1223 | 845 | 536 |
| 2011 | 1702 | 962 | 842 | – |
| 2012 | 1574 | 757 | 563 | – |
| 2013 | 2090 | 1094 | – | 1088 |
| 2014 | 2025 | 1036 | 793 | – |
| 2015 | 1992 | 1040 | 855 | 65 |
| Total | 19397 | 8463 | 4554 | 1689 |

Level 1 teaches the primer and basic numeracy. Level 2 moves on to accessing Ife texts, teaches writing and reinforces numeracy skills. Level 3 teaches transition from Ife to basic French for monolingual students (Reeder, 2017, p. 20). A separate literacy track targets educated Ife, and teaches transition from French to Ife. This course is not offered every year.

The Beninese government provides adult literacy in Yoruba for Ife speakers, on the assumption that this is the common language of all “Nago” speakers. In 2009 the Beninese Ife literacy association petitioned the government to request the recognition of Ife as the language of literacy for their area, but this had not been granted by the time we ran our series of experiments (Reeder, 2017, pp. 27–28).¹⁴

13. Graduation figures for Benin in 2015 are unobtainable, so an estimate was made on the basis of enrolment figures and average annual attrition rates.

14. Or indeed by the time of going to print (Komi Sena, p.c.).

2.2 Literature production

A healthy range of literature has been published in Ife over the last 30 years, including: an alphabet book (Kabo & Kohler, 1983); a pronunciation guide (Gardner & Setodji, 2008); simple reading material for new literates (Agbemadon & Sambogou, 1989); a math course in two volumes; booklets on agriculture, health, and marriage guidance; collections of folktales, poems, stories, and riddles; a bilingual French-Ife booklet about how to fill in government forms; a translation of the New Testament; portions of the Old Testament; a booklet explaining the Bible's historical and cultural background; and a lexicon of Biblical key terms for interpreters. Calendars have published annually since at least 1987.

2.3 Pedagogical materials

2.3.1 *Primer*

The Ife primer (ACATBLI, 2008) is divided into five volumes.¹⁵ The first, which contains 14 lessons, is basically a pre-primer, teaching visual discrimination, then six of the vowels with their keywords as sight words, the two story characters as sight words, the tone marks for H and L, and the letter <W, w>. Numerals from 1 to 20 are also taught in this volume. Volumes 2–5 teach the remainder of the orthography, including not only letters but several grammatical features, as well as elision.

The tone marks for H and L are introduced in lesson 11 using tonal minimal pairs, and reinforced in lesson 12 using two other sets of tonal minimal pairs. This allows learners to see the tone marks on three different vowels <a, o, >. The format of these lessons is an analysis drill of each word then, under each drill, an arrow pointing up for the H on the vowel and down for the L on the vowel. In lesson 11, between these two arrow-and-letter sets is a boxed column with a H tone vowel, a L tone vowel, and a M tone (unmarked) vowel. Then the two keywords are repeated, again under the appropriate tone. In lesson 12, the boxed exercise, including all three introduced vowels with tone marks, is at the bottom of the page (Figure 3).

On the page following the introduction of the tonal minimal pair keywords is a set of “find the same” exercises. The first two lines have a drawing in the initial slot; learners are supposed to find the words that match the drawing. The second two lines have a H tone vowel or a L tone vowel for learners to find in a line of six vowels. The last two lines are for keyword matching (Figure 4).

15. The first edition of the literacy primer series appeared in 1989. For several years, SIL experimented with two parallel versions of the primer series: one for general use, the other for use in church (Gardner, 2003, p. 4). A separate literacy primer has apparently been published in Benin (Kouyoumou, 1991) but we have been unable to obtain a copy.

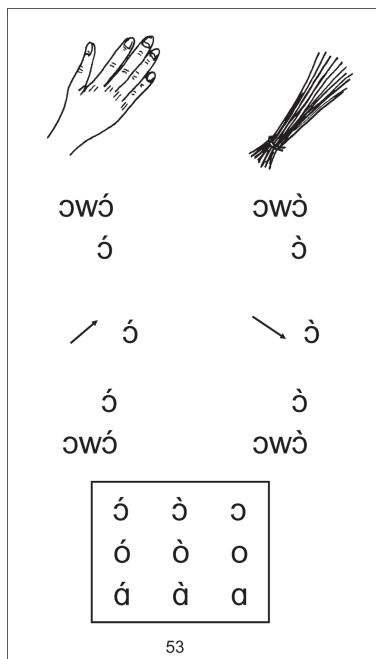


Figure 3. Ife early tone lesson (ACATBLI, 2008, pp. vol. 1, p. 53)

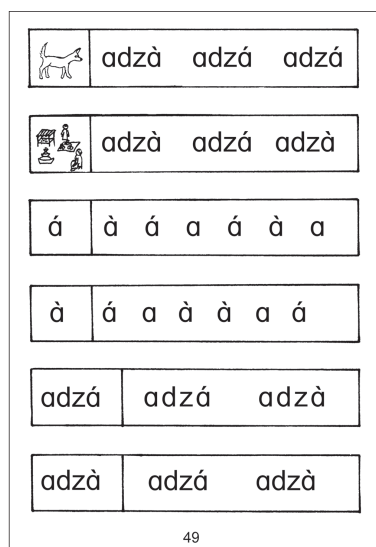


Figure 4. Ife “find the same” exercise (ACATBLI, 2008, pp. vol. 1, p. 49)

The next page of lesson 11 is devoted to writing practice, with the keyword plus the focus vowel and its tone mark. Lesson 12 has an additional activity between the “find the same” exercise and the writing page: a matching exercise of the keywords to the correct drawing to drive home the meaning.

The three tones are then reinforced over the next three lessons, the first of which introduces the letter <w>. All possible syllables beginning with this letter are covered in lessons 13–15, with a different tone in focus for each lesson.

An interesting feature of this primer set – and a major strength – is the addition of a tone drill that follows the same pattern as a contrast drill, and precedes the standard letter-based contrast drill in each new letter lesson. This three-way contrast of tone on three different syllables is practiced in every new letter lesson.

All but one grammar lesson concern grammatical particles that are tonally contrastive with another particle. The exception is a lesson focusing on the written elision that occurs following the preposition /ní/ *in, to, at* which is frequent in natural contexts. In this case, the vowel *í* is dropped in speech and writing before a vowel or liquid. The H tone reassociates to the vowel, or, if before /l/ <l>, to the /n/ <n> which becomes syllabic. The other grammar lessons involve pronouns, including those that are tonal minimal pairs (e.g. /ó/ <ó> 3sg SP and /ò/ <ò> 2sg SP) or involve tonal processes, such as polarity in the object pronouns (see p. 149).

Nasal vowels, marked with a superscript tilde, are taught in volume 4 in three separate lessons. Diacritic stacking, occurring when tone marks are placed above the tilde, is introduced visually in the tone drills and physically in the copying exercises.

The Ife primer is strong in the teaching of tone reading, with the early introduction of tone marks and frequent reinforcement of all three tones in drills. A drawing next to the tone drill would be an improvement. The special grammar lessons to help with particles are another positive point of this primer’s tone pedagogy. To help students learn to write tone marks correctly, the primer gives learners ample practice in copying words and phrases with tone marks. Additionally, at the end of class, teachers give a dictation which is in the teachers’ guide. In the second year of the program, students also have creative writing homework (Akoété Agbémadon, p. c.).¹⁶

2.3.2 *Transition guide*

The Ife transition guide (SIL, 1995)¹⁷ explicitly states that its purpose is to help those Ife who can read French to learn to read their own language. It is styled much as a primer, with a drawing and one or more keywords for each lesson, which is very

16. Akoété Agbémadon is Director of ACATBLI and coordinator of the literacy and development program.

17. The first edition of the Ife transition guide appeared in 1992.

helpful for those whose French is weak. The keywords are the same as those used in the primer. Only the first and second lessons, which focus on vowels and tone respectively, break down the keyword to the focal letter. One of each of the three tonal minimal pairs used to teach tone is taught as a sight word in lesson 1; only H and L are taught through the tonal minimal pairs, but from lesson 2 on, all three tones (H, M, L) are included in the drill box (Figure 5). A three-way contrastive tone drill of the type used in the primer set is found in lessons 2 through 5, 7, 12 and 15. A story to practice the letter follows. The transition guide contains no writing exercises but does include grammar lessons for the same features as those taught in the primer, with identical introductions: elision of ní (*in, to, at*); object pronouns; conjugation via vowel reduplication of the verb with a specified tone; and possessive pronouns.

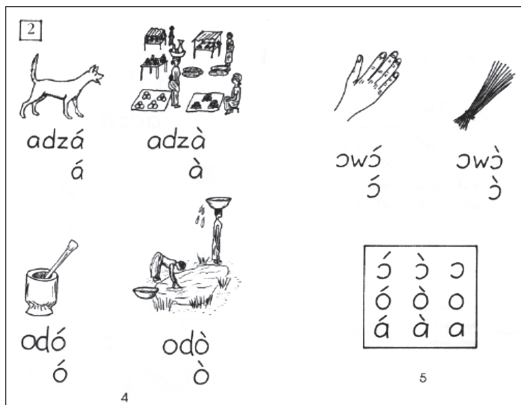


Figure 5. Lesson with tone drill box in the Ife transition guide (SIL, 1995, pp. 4–5)

The final three pages of the transition guide give an outline of Ife grammar for pronouns and verb conjugations. The introduction to the outline specifies that often it is tone alone that distinguishes these particles and reminds readers to pay attention to tone marks.

The Ife transition guide does an adequate job of giving practice in reading tone. Not only does it include a specific lesson to introduce tone on vowels using tonal minimal pairs, it also uses tone drills in seven of the twenty subsequent lessons. Additionally, it includes lessons on grammatical features where tone is a factor. Stories are long and give thorough practice of reading tone on words in context. However, the writing of Ife is not a goal of this transition guide, which limits its usefulness in making Ife literacy applicable to everyday life and communication.

Elip, Mmala and Yangben

(David Roberts, Ginger Boyd, JeDene Reeder)

1. Linguistic and orthographic background

1.1 Affiliation and location

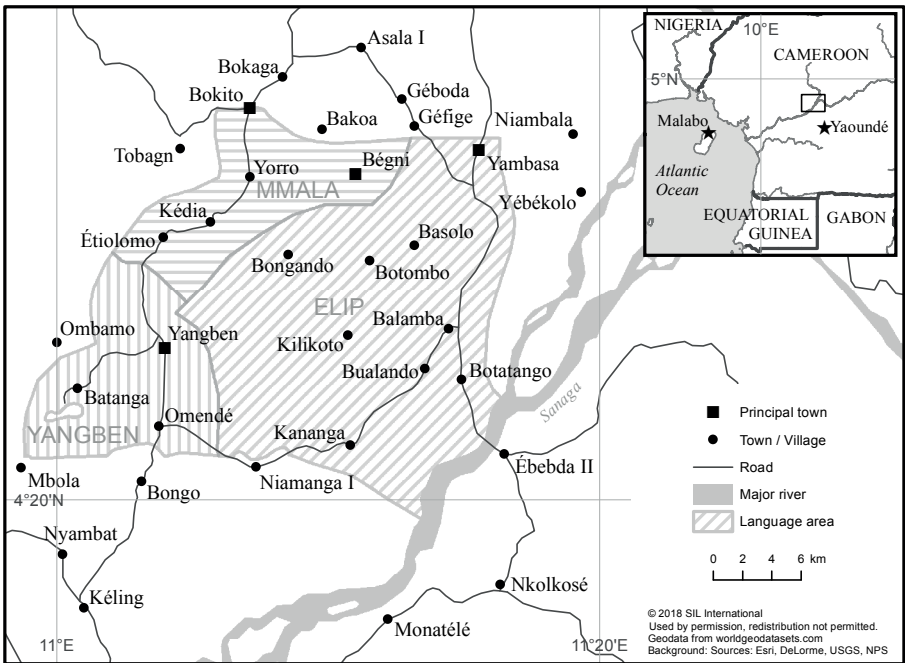


Figure 1. The Elip, Mmala and Yangben language areas

Elip,¹ Mmala² and Yangben³ are Bantu A62 languages (Grollemund, 2012; Guthrie, 1971a, 1971b; Piron, 1995, 1997) generally referred to as “Mbam Bantu” and usually

1. ISO 639-3: ekm. The <Nulíbé> [nùlibé] language is spoken by the <Belíp> [bèlíp] people (sg. <elíp> [èlíp]). Alternative names are Belibi, Belip and Libie.
2. ISO 639-3: mmu. The <Numála> [nùmàlà] language is spoken by the <Bemála> [bèmàlà] people (sg. <Mmála> [ìmmàlà]). Alternative names are Mmaala, Numaala and Numala.
3. ISO 639-3: yav. Yangben speakers do not have a name for a speaker of the language, only for the son of a given village. For example, the <Nukàlɔŋɛ> [nòkàlɔŋè] variety is spoken by

considered genealogically to be between Narrow Bantu and Southern Bantoid. They are spoken in the Mbam-et-Inoubou District of the Centre Region of Cameroon, which is in the francophone zone of the country (Figure 1).

According to Eberhard et al. (2020), Elip has approximately 6,400 speakers, Mmala 8,000, and Yangben 2,300, making them the smallest of the ten focal languages in our series of experiments. All three languages have a history of migration to other regions of Cameroon. Inter-marriage between each other and with other ethnic groups is common. Bilingualism is high in French (the official language), between the three languages, and with neighboring languages. In addition, Yangben is used as an L2 by Bati [btc], Hijuk [hij] and Mbule [mlb] (Eberhard et al., 2020).

1.2 Orthography development

Early research considered Elip, Mmala and Yangben to be dialects of a single language due to the high percentage of lexical cognates, which is judged to be between 70% and 90% depending on the study (Boone et al., 1992; Guarisma & Paulian, 1986; Mous & Breedveld, 1986; Paulian, 1986b). However, it became apparent that the three varieties are too phonologically and grammatically different to consider developing a single orthography. Indeed, the populations themselves resisted choosing one of the three as a reference and, in August 2005, they petitioned SIL Cameroon to consider them as three separate languages for development purposes. By the end of that year, each community had chosen its own reference dialect for orthography development:

- Elip has three dialects: Yambassa (reference), Balamba and Mana-Kanya;
- Mmala has two dialects: Begni (reference) and Kedia;
- Yangben has three dialects: Kalong (reference), Patanga and Omende.

A unified language development program has catered for the three languages in parallel over the past fifteen years but the three orthographies are still very much works in progress. Initial statements were prepared in collaboration with members of the three language committees (Boyd, 2006a, 2006b, 2006c) then revised a decade later (Boyd, 2015c, 2015d, 2016).

Figures 2–4 shows texts written in the standard Elip, Mmala and Yangben orthographies respectively, to show the visual effect of full tone marking.⁴

the <Pápákálɔŋ> [pápákálɔŋ] people (sg. <Upákálɔŋ> [ʊpákálɔŋ]) who inhabit Yangben village. Alternative names for the language as a whole are Kalong, Nukalonge and Nuasue. All publications prior to 2005 use the latter term to refer to all three languages.

4. For the origin of these texts and a free English translation, see p. 30, footnote 8.

Na Ombóge na Mbuá bameéd gá guében ikumb. Bamaábaándá Ombóge uganye gá Mbuá ánee: «Yañuá ññaábulígancɔ uguá bukumb gá giagiá yañuá nnye mɔncɔ nuól. » Bemeémeneg Ombóge uwábulég, uwagása ikumb, uwagása ikumb, gibadá gimaágánye ánee gihón uwegusinye Mbuá ikumb uguá ɔduá, Mbuá uwehéhidinye « Hué! » Ombóge uwasɔs uwoóhun yó ánee: « Anagánye ogodionu ánee ehéhénye uguá gisigel igié disóguól gá buébi a? »

Figure 2. Elip written with full tone marking (Standard orthography)

Na omboko na mbuá mabá begúl bósóɔɔn bigúli gidigidi. Gɔ́ɔ́ɔ́ buóse búmodió bámaán ká báb agá gisién gá ifumbu báb guébén ifumbu. Bámaán na guadóɔ gá gɔb gá guébén ifumbu, abában gegad. Bámaán agá gisién gá ifumbu omboko ganye gá mbuá ká: « Anyé yañuá inyá siɔɔɔɔɔ, mbóléɔ ugumuana ngása ifumbu, añuá ɔ́lɔ́ben agá gúsi ábáda. » Omboko uwédúm gugása ifumbu.

Figure 3. Mmala written with full tone marking (Standard orthography)

Nimbua namfán mapá pekul. Epu puósé, pakany ée pɛɛp kuépe insamó. Pɔmóɔkól mbalá yɔpɔ, pamáyɔk ekisién kimɔɔnd. Pemépiín. Peméen ndín ipuyoyó. Amfán kimbua ée: « Inj inié tukónd kuwáa, yɔkɔ́ɔ́ɔ́ɔ́n kumákat aputé. Inj ímákat, añɔ ɔlɔp ekúsi, injaápá injése apáta. Amfán mámakát ukanye ekése piyoyó utúútan. Mbua páta wákan kimbalá. Mbalá meelé ikanye ekiketékete iwóon, amfán máand atɔɔt ekie kiyoyó, kimáátén mbua ketɔ.

Figure 4. Yangben written with full tone marking (Standard orthography)

1.3 Previous research

A lexicon contains 1,955 words from all three languages with French glosses (Akegne et al., 2002). Elip and Mmala have phonology sketches (Ekambi, 1990; Kaba, 1988) and noun class descriptions (Idiata, 2000; Paulian, 1980). Onana & Roland (2007) investigate Elip verb morphology, while Hyman (2003) explores Yangben vowel harmony. Boyd (2015b) picks up this same theme and extends it to all three languages in the context of a comparative phonology.

1.4 Typology

Elip, Mmala and Yangben are all agglutinative languages with SVO word order, extensive noun class systems and vowel harmony. Elip has ATR and rounding harmony; Mmala has ATR, rounding and height harmony; Yangben has ATR, rounding and fronting harmony. The phonological noun word includes all prepositions and associative markers. Permissible syllable structures are CV, CVC, V, VC, N.

1.5 Consonants

The Mbam languages share the following basic consonant inventory (Table 1).

Table 1. Consonantal grapheme-phoneme correspondences in the Mbam family (based on Boyd, 2015b, pp. 117, 136, 160; 2015c, pp. 8–10; 2015d, pp. 7–9; 2016, pp. 6–7)

| | Labial | Alveolar | Palatal | Velar | Glottal |
|-------------|--------------------------|--------------------------|---------|--------------------------|---------|
| Stop | p ^m b <mb> | t ⁿ d <nd> | | k ^ŋ g <ng> | |
| Fricative | f ^m f <mf> | s ⁿ s <ns> | | | h |
| Nasal | m | n | ɲ <ny> | ŋ | |
| Approximate | | l | y | w | |

However, the three languages represented in our series of experiments have certain specific characteristics:

- In Mmala, all three voiceless stops have voiced counterparts /b, d, g/ which are written <b, d, g>.
- In Elip, two of the stops /t, k/ have voiced counterparts /d, g/ which are written <d, g>.
- In addition to prenasalized stops, all three languages have homorganic nasal noun class prefixes. See Boyd (2015b, pp. 124–125, 145–147, 169–171) for further details. The Elip orthography writes nasal noun-class prefixes even before nasal-initial noun roots.
- In Elip, the prenasalized fricative /ⁿs/ and the syllabic nasal and fricative sequence /ⁿs/, are pronounced [n̠t̠], [n̠t̠] respectively in the reference dialect of Yambassa (as they are in Mmala) and [n̠s, n̠s] respectively in the dialects of Balamba and Mana-Kanya (as they are in Yangben). In all cases they are under-represented as <ns>.
- In Elip and Mmala, the palatal nasal /ɲ/ is written <ni> in word initial position;
- In Elip, the labio-velar approximant /w/ is reserved for borrowed words;
- The phoneme /h/ occurs somewhat frequently in Elip and Mmala, but only in borrowed words in Yangben.
- Mmala has a voiceless palatal affricate that occurs in a few ideophones /t̠t̠/ <c>.

1.6 Vowels

The Mbam languages share a basic nine-vowel inventory (Table 2).⁵

Table 2. Vocalic grapheme-phoneme correspondences in the Mbam family (based on Boyd, 2015b, pp. 119, 138, 162; 2015c, p. 14; 2015d, p. 11; 2016, p. 10)

| | Front | | Back | |
|-------|-------|-----------|-------|-----------|
| | +ATR | -ATR | +ATR | -ATR |
| Close | i <i> | ɪ <i ~ ε> | u <u> | ʊ <u ~ ɔ> |
| Mid | e | ɛ | o | ɔ |
| Open | a | | | |

In all three languages, the phoneme /ɪ/ is represented as <i> in open syllables and as <ε> in closed syllables and word-finally; the same patterning occurs with the corresponding back vowels. These spellings are all allophonic, corresponding to the pronunciation. Conversely, Mmala and Yangben, which both have nine contrastive vowels, under-represent /i, ɪ/ in open syllables as <i> and /ɪ, ε/ in closed syllables and word-finally as <ε>; again, the same patterning occurs with the corresponding back vowels. As for Elip, it has only eight contrastive vowels (/ε/ being absent), but in all other respects follows the same patterning. Figure 5 summarizes these complex phonographic relationships.

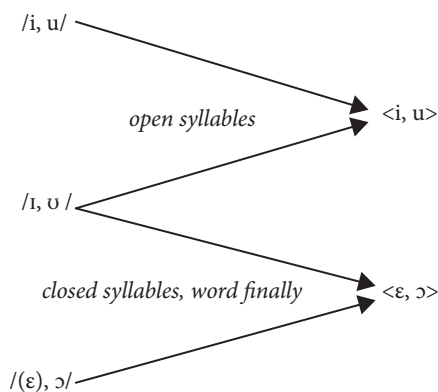


Figure 5. Over- and under-representation of vowels in Elip, Mmala and Yangben

5. While Hyman (2003) posits nine underlying vowels for Yangben, no other previous researcher has observed more than seven. Boyd's (2015b) acoustic research shows that Hyman's underlying vowels do have surface realizations.

In addition, Yangben has very limited contrastive vowel length, which is written by doubling the vowel, e.g. <a ~ aa> (1; Boyd, 2016, p. 10).

- (1) a. Yangben /kò-ték-è/ <kutéke> *hang up (e.g. washing)*
 c15-hang.up-FV
 b. /kò-téék-è/ <kutééke> *hurt*
 c15-hurt-FV

In Elip (2a, 2b) and Mmala (2c, 2d), although associative markers, prepositions and certain conjunctions vary according to the rules of vowel harmony, they are written with consistent word images (Boyd, 2006b, p. 17; 2006c, p. 12; 2015c, pp. 34–40; 2015d, pp. 30–41).

- (2) a. Elip /ùgwá gý-àⁿsì/ → [ùgwá gýà^{nt}fɛ̃] <uguá gianse>
 LOC C7-house
in the house
 b. /ùgwá Ñ-póm/ → [ùgwó ñ-póm] <uguá mpóm>
 LOC C9-forest
in the forest
 c. Mmala /gɪ-àⁿsì gá mú-òⁿd/ → [gýà^{nt}fɛ̃ gá mú-òⁿd] <gianse ga móond>
 C7-house C7.ASS C1-man
house of man
 d. /gɪ-àⁿsì gá sýê/ → [gýà^{nt}fɛ̃ gé sýê] <gianse ga síe>
 C7-house C7.ASS C1.father
house of father

In Yangben on the other hand, similar forms, for example the coordinative conjunction (3), are prefixed to the following noun and written transparently (Boyd, 2015b, pp. 270–271; 2016, p. 25).

- (3) a. Yangben /m̀b̀uǹ ǹè-k̀i-t̀é̀t̀i/ <mbuny nekitéti> *goat and rooster*
 C9.goat CNJ-C7-rooster
 b. /è-m̀èk̀ú ǹà-m̀à-ǹó̀ŋ/ <emekú namanóŋ> *flesh and blood*
 C3-flesh CNJ-C6-blood

1.7 Tone

After a brief overview of how the tone orthographies for the three languages evolved (Section 1.7.1), we list the underlying lexical tone patterns on nouns and verbs (Section 1.7.2), then explain how extra diacritics are avoided in four contexts: non automatic downstep (Section 1.7.3), contour tones (Section 1.7.4), desyllabification of close vowels (Section 1.7.5), and noun class proclitics (Section 1.7.6). We go on to

describe two tonal processes explaining how they are represented orthographically: the interaction between nominal tone, devoicing and elision (Section 1.7.7), and H tone derivational verbs (Section 1.7.8). We end by presenting examples of some of the lexical tone (Section 1.7.9) and grammatical tone (Section 1.7.10) that have been reported in the literature.

1.7.1 *Tone orthography*

The 2006 orthography statements (Boyd, 2006a, 2006b, 2006c) proposed marking lexical tone fully and grammatical tone partially. They advocated differentiating various TAM morphemes individually with an acute accent, without going as far as to represent every case of tonal inflection. However, the resulting deep representations, with their consistent root images, were found to be too abstract and no one ever mastered them. In practice, writers tended to spontaneously mark tone fully, adding an acute accent to mark H tone wherever they heard it. The 2015–2016 orthography reform (Boyd, 2015c, 2015d, 2016) laid a greater emphasis on validating this *de facto* practice, whilst also taking into account more recent linguistic research.⁶ The fact that the revision was ratified in the same year as the experiments took place does not imply that the participants had only minimal time to learn and practice the tone orthographies before being tested. On the contrary, the tone marks in our experimental materials reflect long-standing practice, and these, as it happens, were ratified in the same year.

In the standard orthographies of all three languages, H tone is written with an acute accent and L tone by absence of an accent. Tones are written on all short vowels, on the second vowel of a vowel sequence and on syllabic pre-consonantal nasals.

1.7.2 *Lexical tone patterns*

All three languages have two contrastive tones, automatic and non-automatic down-step. The tone-bearing unit is V and syllabic preconsonantal N. Nasals and other sonorants in coda position are not analyzed as being phonological TBUs. Contour tones are attested on single syllables in all three languages but are rare in Mmala.

All three languages share the same four tone patterns on noun roots: H, L, HL and LH (4; Boyd, 2015b, pp. 135, 159, 180). Surface modifications of these four tone patterns occur in utterance-final position when the final vowel is a close vowel.

6. In particular, cases of wrongly identified tenses and inaccurately transcribed tones came to light in Mmala between the two editions of the orthography statement.

- | | | | | | | |
|-----|----|---------|----|-------------------------|-----------|---------------------------|
| (4) | a. | Elip | H | /nò-bálá/ | <nubálá> | <i>C11-arrival</i> |
| | b. | | L | /ò-là ^m bà/ | <ulamba> | <i>C3-polygamy</i> |
| | c. | | HL | /gì-dámà/ | <gidáma> | <i>C7-okra</i> |
| | d. | | LH | /gì-bàdá/ | <gibadá> | <i>C7-bag</i> |
| | e. | Mmala | H | /gì- ^m bádá/ | <gimbádá> | <i>C7-bottom</i> |
| | f. | | L | /nì-bànà/ | <nibana> | <i>C5-footstep</i> |
| | g. | | HL | /nì-bánà/ | <nibána> | <i>C5-udders, breasts</i> |
| | h. | | LH | /gì-faná/ | <gifaná> | <i>C7-hoof</i> |
| | i. | Yangben | H | /i-kótó/ | <ikótó> | <i>C19-pipe</i> |
| | j. | | L | /nò-kòmò/ | <nukómò> | <i>C11-tree sp</i> |
| | k. | | HL | /nò-pónò/ | <nupónò> | <i>C11-file</i> |
| | l. | | LH | /nò-pòtò/ | <nuputò> | <i>C11-wasp</i> |

As for verbs, it is impossible to establish underlying melodies on the basis of the citation forms, because the latter neutralize the contrast between H and HL. Rather, in Elip and Mmala the underlying melodies emerge in the diminutive and the intensive diminutive forms respectively, straddling the root and the suffix and revealing three tone patterns: H, L and HL (5; Boyd, 2015b, p. 135).⁷

- | | | | | | | |
|-----|----|-------|----|-----------------------------|------------------|-------------|
| (5) | a. | Elip | H | /gò-góg-îd/ | | <gugógééd> |
| | | | | C15-drag-DIM | | |
| | | | | <i>drag a little</i> | | |
| | b. | | L | /gò-dàn-îd/ | | <gudanéd> |
| | | | | C15-pound-DIM | | |
| | | | | <i>pound a little</i> | | |
| | c. | | HL | /gò-bám-îd/ | | <gubáméd> |
| | | | | C15-talk.loudly-DIM | | |
| | | | | <i>talk loudly a little</i> | | |
| | d. | Mmala | H | /gò-dád-îd-îd/ | → [gò-dád-éd-èd] | <gudádédéd> |
| | | | | C15-crow-DIM-DIM | | |
| | | | | <i>crow a very little</i> | | |
| | e. | | L | /gò-bàŋ-îd-îd/ | | <gubaŋédéd> |
| | | | | C15-cry-DIM-DIM | | |
| | | | | <i>cry a very little</i> | | |
| | f. | | HL | /gò-gás-îd-îd/ | | <gugásédéd> |
| | | | | C15-pick-DIM-DIM | | |
| | | | | <i>pick a very little</i> | | |

The intensive diminutive does not exist in Yangben, but the same three-way contrast is attested in causative constructions. In fact, it is more easily identifiable in Yangben

7. The underlying form emerges most obviously and simply in the intensive diminutive forms, but this form is not always attested, which is why the examples here contain a mixture of diminutive and intensive diminutive forms.

than in the other languages because of the presence of non-automatic downstep in the H tone class (6; Boyd, 2015b, p. 181).

- (6) a. Yangben H /kù-pééⁿd-⁺én-ì/ <kupééndéni> *spy on (capture)*
 C15-spy.on-CNT-CST
 b. L /kù-kèèk-èn-ì/ <kukeekeni> *cause to stutter*
 C15-stutter-CNT-CST
 c. HL /kù-síít-èn-ì/ <kusíiteni> *stir-up (fire, emotions)*
 C15-stir.up-CNT-CST

This brings us to our next topic, since non-automatic downstep occurs in all three languages. The following section summarizes its various manifestations.

1.7.3 Non-automatic downstep

Non-automatic downstep is under-represented in all three orthographies; [⁺H] is always written with an acute accent <◌́>, like [H]. In Elip, it is found in two grammatical contexts: between the class 2 plural prefix and the H tone of the recent past morpheme (7a), and between the distant past morpheme and the verb root in the L tone verb class (7b). In Mmala, it occurs in the present and immediate future tenses (7c). In Yangben it occurs in the recent past (7d) and the immediate future in the H tone verb class (7e).

- (7) a. Elip /b́-⁺mó-g̀òl/ → [b́⁺mó̀g̀òl] <b́mó̀g̀òl>
 C2-PST1-crush
they crushed (just now)
 b. /ò-àá-nòdà/ → [wàá⁺nó́dà] <wàánúdá>
 C1-PST3-vomit
he/she vomited (before yesterday)
 c. Mmala /ò-gàg̀ó-yáŋ-à/ → [ògàg̀ó⁺yáŋ-à] <ugagúyánga>
 C1-FUT1-grill-FV
he/she will grill (later today)
 d. Yangben /ò-mé-té́k-é/ → [òmé⁺té́k] <umété́ké>
 C1-PST4-hang.up-FV
he/she hung up (just now)
 e. /ò-kàn é-té́k-è/ → [òkàn é⁺té́k] <ukan été́ke>
 C1-FUT1 ?-hang.up
he/she will hang up (later today)

For an analysis of the causes of downstep, see Boyd (2015b, pp. 180–181). Extensive field observation reveals that L1 speakers are completely unaware of the phenomenon, and that they consistently hear downstepped H tones as H. Decision makers strongly resisted representing non-automatic downstep in the orthographies of these three languages.

1.7.4 Contour tones

Contour tones on single phonological TBUs are spelled with double vowels in Yangben and Elip (8; Boyd, 2015c, pp. 22–23; 2016, p. 16). In Elip, this strategy is straightforward because the language does not have contrastive vowel length. Yangben, on the other hand, does have length contrast, albeit with a very light functional load.⁸

- (8) a. Elip /gì-gǒge/ <gigoóge> c7-bone
 b. Yangben /à-sǎ/ <asaá> c3-river

As for Mmala, it has only a few contours, so the decision was made to underrepresent them. All contours, whether HL or LH are written as H (9; Boyd, 2015c, pp. 18–19)

- (9) a. Mmala /b̀-̀d̀éd/ <budéd> c14-tree
 b. /b̀-̀t̀h̀ǎ/ <botǎ> c14-yellow yam
 c. /m̀-̀l̀énd/ <mulénd> c19-algae

1.7.5 Desyllabification of close vowels

When a close vowel /i, u/ is followed by another vowel, the former is desyllabified, resulting in a contour tone. The vowel and its tone are maintained in the orthographies, always being written on the second vowel of the sequence (10; Boyd, 2015c, pp. 16–18; 2015d, pp. 13–14; 2016, pp. 11–13).

- (10) a. Elip /m̀-̀s̀n/ → [m^wǎn] <muǎn> c1-baby
 b. Mmala /g̀-̀ó^mb/ → [g^yǎ^mb] <giómb> c7-weeding stick
 c. Yangben /p̀-̀ék/ → [p^wék] <puék> c14-porcupine

1.7.6 Noun class proclitics

In all three languages, all noun class proclitics except classes 1 and 9 are H tone, and because of their regularity it was felt that it was unnecessary to mark them in the orthography (11).

8. Unsurprisingly, there has been greater resistance to this strategy in Yangben, so the 2016 orthography reform made certain compromises. See Boyd (2016, pp. 18–19) for further details.

- (11) a. Elip /hú-mà-gàd-ìg/ <humagadɛg>
 C3-PST4-broken-DET
It (barrier) is broken.
- b. Mmala /mú-gù-sòb-òn mbasa/ <mugusɔ̀bɔ̀n mbasa>
 CMU-PST3-peck-EXT maize
They (guineafowls) pecked at the maize.
- c. Yangben /má-mà-sák kɔ́-òm/ <mamasák kɔ́ɔ̀m>
 C6-PST3-invaded C17-place
It (water) flooded the place.

1.7.7 Nominal tone, devoicing and elision

In the nouns of all three languages, underlying tones sometimes surface with different tone patterns in utterance final position, even in citation forms. This process, in turn, conditions the devoicing or elision of the close vowels /i, ɪ, u, ʊ/, and the devoicing of preceding obstruents. Although each language differs in its application of these processes, all three orthographies consistently represent the non-final forms (Boyd, 2015c, pp. 18–19; 2015d, pp. 15–16; 2016, pp. 13–14).

In Elip, the /HL/ tone pattern surfaces as [L] in utterance final position, thus neutralizing the contrast between /HL/ and /L/. The /H/ tone pattern, in turn, surfaces as [HL] in the same position. In general, nouns ending with an underlying /L/ tone (/L, HL/) tend to provoke vowel elision, whereas those ending with an underlying /H/ tone (/H, LH/) tend towards vowel devoicing. However, the /H/ pattern may trigger elision, whereas the /LH/ pattern never does. In all cases of devoicing, the vowel is pronounced with a voiceless $\bar{\text{L}}$ tone.⁹ In cases of vowel elision, a preceding obstruent may also devoice. Table 3 summarizes these alternations (where $\bar{\text{L}}$ indicates the devoicing of the supporting vowel, and ($\bar{\text{L}}$) its devoicing and possible elision) and Table 4 provides some examples.

Table 3. Interaction between tone patterns, voicing and elision in Elip

| Root pattern | Pronunciation | | V devoicing | V elision |
|--------------|---------------|----------------------------|-------------|-----------|
| | Non-final | Final | | |
| /H/ | [L-H.H] | [L-H.($\bar{\text{L}}$)] | Yes | Optional |
| /L/ | [L-L.L] | [L-L] | No | Yes |
| /HL/ | [L-H.L] | [L-L] | No | Yes |
| /LH/ | [L-L.H] | [L-L. $\bar{\text{L}}$] | Yes | No |

9. Speakers of all three languages perceive a tone on these devoiced vowels even though this is difficult to demonstrate acoustically.

Table 4. Examples of Elip vowel devoicing and elision

| | Root pattern | Pronunciation | | Orthography | |
|-----|--------------|--------------------------------------|--------------------------------------|-------------|-------------------------|
| | | Non-final | Final | | |
| /i/ | /L/ | [bì-g ^w ìdì] | [bì-g ^w ìd̥] | <biguidi> | <i>C8-rubbish</i> |
| | /LH/ | [gì-gòdì] | [gì-gòd̥] | <gigodí> | <i>C7-law</i> |
| /ɪ/ | /L/ | [g ^y -à ⁿ tʃì] | [g ^y -à ⁿ tʃ̥] | <gianse> | <i>C7-house</i> |
| | /HL/ | [g ^y -ǎ ⁿ tʃì] | [g ^y -ǎ ⁿ tʃ̥] | <giánse> | <i>C7-cockroach</i> |
| | /LH/ | [g ^y -à ⁿ tʃí] | [g ^y -à ⁿ tʃ̥] | <giansé> | <i>C7-refusal</i> |
| /u/ | /H/ | [gì-dégú] | [gì-dég̥ ~ gì-dég̥ù] | <gidégú> | <i>C7-avel</i> |
| | /LH/ | [m̄-mègú] | [m̄-mèg̥ù] | <mmejú> | <i>C9-muscle, flesh</i> |
| /ʊ/ | /L/ | [mò- ⁿ dò] | [mò- ⁿ d̥] | <mund> | <i>C1-man</i> |
| | /LH/ | [gì-lò ⁿ dó] | [gì-lò ⁿ d̥] | <gilondó> | <i>C7-cloud</i> |

The processes are similar in Mmala. As before, the underlying /HL/ pattern surfaces as [L] and the underlying /H/ pattern surfaces as [HL] in utterance final position, but these changes trigger distinctive devoicing and elision alternations. All the vowels obligatorily devoice and optionally elide, except in the environment of an underlyingly /LH/ tone pattern. As before, in cases of vowel elision, a preceding obstruent may also devoice. Table 5 summarizes these alternations and Table 6 provides some examples.

Table 5. Interaction between tone patterns, voicing and elision in Mmala

| Root pattern | Pronunciation | | V devoicing | V elision |
|--------------|---------------|------------|-------------|-----------|
| | Non-final | Final | | |
| /H/ | [L- H.H] | [L-H.(L̥)] | Yes | Optional |
| /L/ | [L-L.L] | [L-L.(L̥)] | Yes | Optional |
| /HL/ | [L-H.L] | [L-L.(L̥)] | Yes | Optional |
| /LH/ | [L-L.H] | [L-L.L] | No | No |

As for Yangben, the utterance-final tonal alternations are even more distinctive. The underlying word level /L-H/ pattern surfaces with a [H] tone on the noun class prefix, followed by non-automatic downstep at the morpheme boundary between the prefix and the root, so the surface form of the word is [H-[↓]HL]. Also, the underlying /HL/ tone pattern is maintained in the surface form, unlike Elip and Mmala. As for the devoicing and elision processes they are identical to Mmala. Table 7 summarizes these alternations and Table 8 provides some examples.

Table 6. Examples of Mmala vowel devoicing and elision

| | Root pattern | Pronunciation | | Orthography | |
|-----|--------------|-------------------------|--|-------------|-------------------------|
| | | Non-final | Final | | |
| /i/ | /L/ | [bì-gùdì] | [bì-gùḍ ~ bì-gùḍì] | <bigudi> | <i>C8-rubbish</i> |
| | /HL/ | [gì-dédi] | [gì-dèḍ ~ gì-dèḍì] | <gidédi> | <i>C7-rooster</i> |
| | /LH/ | [ì-nòní] | [ì-nòní] | <inoní> | <i>C19-bird</i> |
| /ɪ/ | /L/ | [gʸ-à ⁿ tʃì] | [gʸ-à ⁿ tʃ ~ gʸ-à ⁿ tʃì] | <gianse> | <i>C7-house</i> |
| | /LH/ | [gʸ-à ⁿ tʃí] | [gʸ-à ⁿ tʃí] | <giansé> | <i>C7-pledge</i> |
| /u/ | /H/ | [gì-dégú] | [gì-dég ~ gì-dégù] | <gidégú> | <i>C7-navel</i> |
| | /LH/ | [è-mèk ^h ú] | [è-mèk ^h ù] | <emekú> | <i>C3-muscle, flesh</i> |
| /ʊ/ | /L/ | [bà-à ⁿ dò] | [bà-à ⁿ ḍ ~ bà-à ⁿ ḍò] | <baandɔ> | <i>C2-people</i> |
| | /HL/ | [àn-tʃámò] | [àn-tʃám ~ àn-tʃámò] | <ansámɔ> | <i>C3-grain</i> |
| | /LH/ | [gì-sàsú] | [gì-sàsù] | <gisasó> | <i>C7-granary</i> |

Table 7. Interaction between tone patterns, voicing and elision in Yangben

| Root pattern | Pronunciation | | V devoicing | V elision |
|--------------|---------------|-------------------------|-------------|-----------|
| | Non-final | Final | | |
| /H/ | [L-H.H] | [H- ^ˈ H.(L)] | Yes | Optional |
| /L/ | [L-L.L] | [L-L.(L)] | Yes | Optional |
| /HL/ | [L-H.L] | [L-H.(L)] | Yes | Optional |
| /LH/ | [L-L.H] | [L-L.H] | No | No |

Table 8. Examples of Yangben vowel devoicing and elision

| | Root pattern | Pronunciation | | Orthography | |
|-----|--------------|-------------------------|--|-------------|-------------------------------|
| | | Non-final | Final | | |
| /i/ | /H/ | [kì-tólí] | [kí- ^ˈ tól ~ kí- ^ˈ tólì] | <kitólí> | <i>C7-ant</i> |
| | /LH/ | [kì-tòlì] | [kì-tòlì] | <kitolí> | <i>C7-musical form</i> |
| /ɪ/ | /L/ | [kʸ-à ⁿ sì] | [kʸ-à ⁿ s ~ kʸ-à ⁿ sì] | <kianse> | <i>C7-house</i> |
| | /HL/ | [kʸ-ǎ ⁿ sì] | [kʸ-ǎ ⁿ s ~ kʸ-ǎ ⁿ sì] | <kiáanse> | <i>C7-mutter, growl</i> |
| | /LH/ | [kʸ-à ⁿ sí] | [kʸ-à ⁿ sí] | <kiansé> | <i>C7-challenge</i> |
| /u/ | /HL/ | [kì-tékù] | [kì-ték ~ kì-tékù] | <kitéku> | <i>C7-navel</i> |
| | /LH/ | [è-mèkú] | [è-mèkú] | <emekú> | <i>C7-muscle, flesh</i> |
| /ʊ/ | /HL/ | [à-káá ⁿ dò] | [à-káá ⁿ ḍ ~ à-káá ⁿ ḍò] | <akááandɔ> | <i>C1-woman</i> |
| | /LH/ | [kì-tèkó] | [kì-tèkó] | <kitekó> | <i>C7-gift of forgiveness</i> |

1.7.8 *H tone derivational verbs*

The surface realizations of derivational H tone verbs differ from language to language. In Elip, when a H verb (12a) appears in utterance final position with a derivational suffix (12b), the H tone of the verb root spreads onto the suffix, resulting in a HL contour on a short vowel. In the orthography, the vowel is doubled to represent the falling tone (Boyd, 2015b: 23). However, if two derivational suffixes are present (12c), the H tone of the root spreads only onto the first suffix and the suffixes are spelled with short vowels.

- (12) a. Elip /gò-góg-à/ <gugóga> drag
c15-drag-FV
- b. /gò-góg-ìd/ → [gò-góg-êd] <gugógééd> drag a little
c15-drag-DIM
- c. /gò-góg-ìd-ìd/ → [gò-góg-éd-èd] <gugógédèd> drag a very little
c15-drag-DIM-DIM

No such contours are attested in the corresponding Mmala forms. In that language, when a H verb (13a) appears in utterance final position with a derivational suffix (13b), the H tone of the verb root still spreads rightwards on to the suffix but this time eliminates the L tone. When two suffixes are added (13c), the H tone of the root spreads only to the first, as in Elip.

- (13) a. Mmala /gò-gás-à/ <gugása> pick (fruit)
c15-pick-FV
- b. /gò-gás-èd/ → [gògáséd] <gugáséd> pick a little
c15-pick-DIM
- c. /gò-gás-èd-èd/ → [gògásédèd] <gugásédèd> pick a very little
c15-pick-DIM-DIM

As for Yangben, H tone derivational verbs contain no H tone spreading. Instead, they are marked with non-automatic downstep between the H tone of the verb root and the H tone of the adjacent suffix. The downstep is under-represented in the orthography (14).

- (14) a. Yangben /kù-éy-ím-ìt/ → [k^wé⁺yímèt] <kuéyímet>
c15-lean.against-POS-DIM
lean against a little
- b. /kù-sék-ési/¹⁰ → [kùsé⁺kési] <kusékési>
c15-dry-CST
cause to dry up

10. Yangben has two causative suffixes, [-i] and [-ési], that appear to have the same meaning.

- c. /kù-pééⁿd-én-ì/ → [kùpééⁿdéni]
 C15-spy.capture-APP-CST
 <kupééndéni>
spy on to capture

In Yangben H tone verbs with closed syllables, a H tone on a short vowel is realized as a L tone (15a–d), and on a long vowel as HL (15e–h). In both cases, the orthography represents the underlying forms.

- | | | | | | |
|---------|---------|-----------|-----------|----------|--------------------------------------|
| (15) a. | Yangben | /kù-tím/ | [kù-tím] | <kutím> | C15-dig |
| b. | | /kò-fát/ | [kò-fát] | <kufát> | C15-husk (corn) |
| c. | | /kò-kót/ | [kò-kòt] | <kukót> | C15-fasten, bind |
| d. | | /kò-sók/ | [kò-sòk] | <kusók> | C15-extract |
| e. | | /kù-tíín/ | [kù-tíín] | <kutíín> | C15-flee in fear |
| f. | | /kò-fáát/ | [kò-fáát] | <kufáát> | C15-carve, sharpen |
| g. | | /kò-póók/ | [kò-póók] | <kupóók> | C15-cook meat (wrapped in leaves) |
| h. | | /kò-sóók/ | [kò-sóók] | <kusóók> | C15-grow (of plants) |

1.7.9 Lexical tone

Lexical tonal minimal pairs among nouns are uncommon, but Boyd cites several cases in Elip (16a; 2015c, pp. 23–24), Mmala (16b; 2015b, p. 159) and Yangben (16c; 2015b, p. 180; 2016, pp. 17–18).

- | | | | | | |
|---------|---------|------------|------------------------|-----------|-------------------|
| (16) a. | Elip | /gì-sóm̩b/ | → [gìsóm̩b̩] | <gisóm̩b> | C7-mound |
| | | /gì-sòm̩b/ | → [gìsòm̩b̩] | <gisòm̩b> | C7-medicinal root |
| b. | Mmala | /gì-sàs/ | | <gisas> | C7-chest |
| | | /gì-sás/ | | <gisás> | C7-carp sp. |
| c. | Yangben | /pò-ólí/ | → [p ^w ólí] | <puólí> | C14-work (n.) |
| | | /pò-òlí/ | → [p ^w òlí] | <puolí> | C14-fishing net |

Boyd also cites several cases of lexical tonal minimal pairs among verbs in Elip (17a; 2015c, pp. 23–24), Mmala (17b; 2015d, p. 19) and Yangben (17c; 2016, pp. 17–18, 22).

- | | | | | |
|---------|-------|---------------|-----------|---------------------------------|
| (17) a. | Elip | /gò-gól/ | <gugól> | <i>to take</i> |
| | | C15-take | | |
| | | /gò-gòl/ | <gugòl> | <i>to crush</i> |
| | | C15-crush | | |
| b. | Mmala | /gò-bàŋ-ìd/ | <gubàŋéd> | <i>to shell (nuts) a little</i> |
| | | C15-shell-DIM | | |
| | | /gò-bàŋ-ìd/ | <gubàŋed> | <i>to weep a little</i> |

| | | | |
|----|-------------------------------|------------|--------------------|
| | C15-weep-DIM | | |
| c. | Yangben /kù- kínd -èn/ | <kukínden> | <i>to obstruct</i> |
| | C15-obstruct-CNT | | |
| | /kù- kínd -èn/ | <kukinden> | <i>to knock</i> |
| | C15-knock-CNT | | |

1.7.10 Grammatical tone

All three languages have the same basic TAM system, comprising eight tenses: four past, one present and three future. In Elip, three pairs of tenses contrast only by their tone patterns in some verb forms (18; Boyd, 2015c, pp. 25, 28).

| | | | | | |
|------|----|------|-----------------------|-----------|--|
| (18) | a. | Elip | /ù-mà- bál / | <umabál> | <i>he/she snatched (before yesterday)</i> |
| | | | C1-PST4-s snatch | | |
| | | | /ù-má- bál / | <umábál> | <i>he/she snatched (just now)</i> |
| | | | C1-PST1-s snatch | | |
| | b. | | /ù-gǎ- bál / | <ugaábál> | <i>he/she will snatch (later today)</i> |
| | | | C1-FUT1-s snatch | | |
| | | | /ù-gà- bál / | <ugabál> | <i>he/she will snatch (tomorrow)</i> |
| | | | C1-FUT2-s snatch | | |
| | c. | | /ù-ṣ-dṣl- á / | <wɔ́dṣlá> | <i>he/she twisted (yesterday)</i> |
| | | | C1-PST3-twist-FV | | |
| | | | /ù-ṣ-dṣl- à / | <wɔ́dṣla> | <i>he/she twists</i> |
| | | | C1-PRS-twist-FV | | |
| | d. | | /ù-mà- gíg -á/ | <umagígá> | <i>he/she dwelled (before yesterday)</i> |
| | | | C1-PST4-dwell-FV | | |
| | | | /ù-mà- gíg -à/ | <úmagíga> | <i>(where) he/she dwelled (before yesterday)</i> |
| | | | C1/SUB-PST4-dwell-FV | | |

In Mmala, two pairs of tenses contrast only by their tone patterns in some verb forms (19; Boyd, 2015d, p. 22).

| | | | | | |
|------|----|-------|-----------------------|--------------------------|---------------------------------------|
| (19) | a. | Mmala | /ù-mà-làf- á / | <umalafá> | <i>he/she tore (before yesterday)</i> |
| | | | C1-PST4-tear-FV | | |
| | | | /ù-má-làf- á / | <umálafá> | <i>he/she tore (just now)</i> |
| | | | C1-PST1-tear-FV | | |
| | | | /ù-mǎ-làf- á / | <umaálafá> ¹¹ | <i>(when) he/she tore...</i> |
| | | | C1-PST4.SUB-tear-FV | | |

11. In this form, a floating H tone associates to the preceding phonological TBU and causes a contour tone. This is represented in the orthography with a long vowel.

- b. /ó-gù-ón-ò/ → [úgʷǒnò] <úguóno> *he/she killed (yesterday)*
 C1-PST3-kill-FV
 /ù-gù-ón-ò/ → [ùgʷǒnò] <uguóno> *he/she kills*
 C1-PRS-kill-FV

The interface between lexical and grammatical tone in Mmala, coupled with the decision to under-represent contours, sometimes results in heterophonic homographs (20; Boyd, 2015d, p. 22).

- (20) Mmala /ù-mǒn-ó/ <umónó> *he/she laughed (just now)*
 C1-PST1.laugh-FV
 /ù-mǒn-ó/ <umónó> *he/she killed (before yesterday)*
 C1-PST4.kill-FV
 /ù-món-ó/¹² <umónó> *he/she killed (just now)*
 C1-PST1.kill-FV

In Yangben, two sets of tenses contrast only by their tone patterns in some verb forms (21; Boyd, 2016, p. 19).

- (21) a. Yangben /ù-mǒ-kǒl-ón/ <umókólón> *he/she took (before yesterday)*
 C1-PST4-take-CNT
 /ù-mǒ-kǒl-ón/ <umókólón> *he/she took (just now)*
 C1-PST1-take-CNT
 /ù-mǒ-kǒl-ón/ <umókólón> *(when) he/she took (before yesterday)*
 C1-PST4.SUB-take-CNT
 b. /ù-ó-kòl-ón/ <wókólón> *he/she slapped (yesterday)*
 C1-PST3-slap-CNT
 /ù-ó-kòl-òn/ <wókólón> *he/she slaps*
 C1-PRS-slap-CNT

Numerous morpheme-level tonal minimal pairs are found among Elip, Mmala and Yangben verbal proclitics (Table 9; Boyd, 2015a, pp. 16–18, 32–33; Isaac & Boyd, 2015, pp. 19–20; Satre & Boyd, 2015, pp. 28–31).

12. This Mmala word is pronounced [ùmónó] *he/she killed (just now)*. It is the only case of a phonetic HM contour in this chapter and would merit further analysis.

Table 9. Tonal minimal pairs among Elip, Mmala and Yangben verbal proclitics

| | | | | |
|---------|---------|------|--------------|--------------|
| Elip | 3SG C11 | /nó/ | [nú, nó] | <nú> |
| | 2PL | /nò/ | [nù, nò] | <nu> |
| Mmala | 3SG C3 | /ó/ | [ú, ó] | <ú> |
| | 3SG C1 | /ò/ | [ù, ò] | <u> |
| | 3PL C6a | /á/ | [á, é, ʒ, ó] | <á, é, ʒ, ó> |
| | 2SG | /à/ | [à, è, ò, ò] | <a, e, ɔ, o> |
| | 3SG C11 | /nó/ | [nú, nó] | <nú> |
| Yangben | 2PL | /nò/ | [nù, nò] | <nu> |
| | 3SG C3 | /ó/ | [ú, ó] | <ú> |
| | 3SG C1 | /ò/ | [ù, ò] | <u> |
| | 3PL C4 | /sí/ | [sí, sí] | <sí> |
| | 3PL C10 | /sì/ | [sì, sì] | <si> |
| | 3SG C19 | /í/ | [í, í] | <í> |
| | 3SG C9 | /ì/ | [ì, ì] | <i> |
| | 3SG C11 | /nó/ | [nú, nó] | <nú> |
| | 2PL | /nò/ | [nù, nò] | <nu> |
| | 3PL C13 | /tó/ | [tú, tó] | <tú> |
| | 1PL | /tò/ | [tù, tò] | <tu> |

In all three languages, the actual number of word level ambiguities among verb forms is greatly multiplied by the various agreement proclitics, whether or not they are tonal minimal pairs at the morpheme level.

In addition, numerous tonal minimal pairs are found among proximal demonstrative adjectives and relative pronouns.¹³ In Elip, all the noun classes produce tonal minimal pairs (Table 10; Boyd, 2015a, p. 11; Isaac & Boyd, 2015, pp. 8–9, 11; Satre & Boyd, 2015, pp. 12, 25).¹⁴

13. In all three languages relative pronouns are easily elicited but not as evident in natural contexts. An analysis of them would make an interesting subject for future research.

14. The non-sequential noun class numbering in Table 10 represent reflexes from the assumed noun classes of proto-Bantu.

Table 10. Tonal minimal pairs among Elip proximal demonstrative adjectives and relative pronouns

| NC | Proximal demonstrative adjectives | | Relative pronouns | |
|----|-----------------------------------|--------|-------------------|---------|
| 1 | /òyḁ̀/ | <uyḁ> | /òyǎ́/ | <uyḁ́> |
| 2 | /ḁ̀bḁ̀/ | <ḁbḁ> | /ḁ̀bǎ́/ | <ḁbḁ́> |
| 3 | /òhḁ̀ḁ̀/ | <uhuḁ> | /òhḁ̀ḁ́/ | <uhuḁ́> |
| 4 | /ìsìè/ | <isìe> | /ìsìé/ | <isìé> |
| 5 | /ìníè/ | <inìe> | /ìníé/ | <inìé> |
| 6a | /ḁ̀yḁ̀/ | <ḁyḁ> | /ḁ̀yǎ́/ | <ḁyḁ́> |
| 7 | /ìgìè/ | <igìe> | /ìgìé/ | <igìé> |
| 8 | /ìbìè/ | <ibìe> | /ìbìé/ | <ibìé> |
| 9 | /ìyè/ | <iyè> | /ìyé/ | <iyéé> |
| 10 | /ìsìè/ | <isìe> | /ìsìé/ | <isìé> |
| 11 | /ònḁ̀ḁ̀/ | <unuḁ> | /ònḁ̀ḁ́/ | <unuḁ́> |
| 13 | /òdḁ̀ḁ̀/ | <uduḁ> | /òdḁ̀ḁ́/ | <uduḁ́> |
| 14 | /òbḁ̀ḁ̀/ | <ubuḁ> | /òbḁ̀ḁ́/ | <ubuḁ́> |
| 6 | /ḁ̀mḁ̀/ | <ḁmḁ> | /ḁ̀mǎ́/ | <ḁmḁ́> |
| 19 | /ìhìè/ | <ihìe> | /ìhìé/ | <ihìé> |
| mu | /òmḁ̀ḁ̀/ | <umuḁ> | /òmḁ̀ḁ́/ | <umuḁ́> |
| 15 | /ògḁ̀ḁ̀/ | <uguḁ> | /ògḁ̀ḁ́/ | <uguḁ́> |

In Mmala and Yangben, on the other hand, tonal minimal pairs between proximal demonstrative adjectives and relative pronouns are fewer (Table 11).

Table 11. Tonal minimal pairs among Mmala and Yangben proximal demonstrative adjectives and relative pronouns

| | NC | Proximal demonstrative adjectives | | Relative pronoun | |
|---------|----|-----------------------------------|-------|------------------|-------|
| Mmala | 6 | /èmè/ | <eme> | /èmé/ | <emé> |
| Yangben | 2 | /èpè/ | <epe> | /èpé/ | <epé> |
| | 6 | /èmè/ | <eme> | /èmé/ | <emé> |
| | 17 | /èkè/ | <eke> | /èké/ | <eké> |

For an analysis of the level of written ambiguity in Elip in comparison with that of Mbelime and Eastern Dan see Roberts et al. (2020).

2. Literacy background

2.1 Literacy programs

In Elip, since 2012, a mother-tongue club has been running at the Government High School in the town of Yambassa for extracurricular activities using the local languages. In 2014, training was held for eight state primary school teachers in six villages and one teacher for adult literacy. In Mmala, in 2013, language and literacy classes were held in each of the village primary schools of all five villages, in addition to four church-based classes for adults. In Yangben, in 2013, language and literacy classes were held in five primary and secondary schools. Although the three literacy programs are of modest size, they have the distinction of being the only focal languages other than Yoruba whose literacy programs cater for children as well as adults.

2.2 Literature production

Literature production in Elip, Mmala and Yangben is only just beginning. Apart from the pedagogical materials discussed in the following section, it is limited to a math booklet in Mmala, and small portions of the Bible in all three languages.

2.3 Pedagogical materials

2.3.1 *Primers*

While each of the primers presented here uses the Gudschinsky method (Lee, 1982), the manner of introducing tones and using tone marks in the exercises varies. Elip and Mmala both introduce tone with the same method and using the same symbol. Yangben, however, uses a method that is unique among the primers discussed in this book.

2.3.1.1 *Elip*

The Elip primer (Bábaóga & Bédilène, 2009) uses a picture of a log drum to signal tone exercises. It begins with four tone pre-lessons that use the contrast exercises (Figure 6) recommended by Wiesemann (1995, p. 29). In subsequent lessons, it reinforces tone awareness through the use of a two-word tone drill.

Although the syllable of the keyword used has an acute accent to mark H tone in lesson 2, the synthesis and identification drills for that lesson do not use acute accents. On the other hand, this lesson does have a tone drill, and tone is written on the syllable level for the built word. This pattern continues through lesson 9, where the syllable of the keyword used does have an acute accent to signal H tone and that syllable with its tone mark is used throughout the drills. After this point, sometimes the tone of the syllable is kept for the drills, other times not.

Ugelu 1 



ηηág
ηηág ηηág ηηág
ηηág ηηag ηηág



ηηag
ηηág ηηág ηηág
ηηag ηηág ηηág



nuǎl
nuǎl nuǎl nuǎl
nuǎl nuǎl nuǎl



nuǎl
nuǎl nuǎl nuǎl
nuǎl nuǎl nuǎl

4


Figure 6. Elip tone awareness drill (Bábaóga & Bédiléne, 2009, p. 4)

From lesson 3, tonal and other word transformations resulting from affixes are introduced in built word exercises. The built words are in trapezoidal boxes, as is often the case in Gudschinsky-style primers. However, in this primer, an affixed form may be written below the box, as in Figure 7, where the numbered box 4 shows the alternate format for built words. This strategy is used both to show how tone marks shift and how segments change according to affix.

A few grammatical tonal minimal pairs are introduced in the grammar exercises at the top of the facing page of most lessons. Grammatical pairs, such as the demonstrative and the relative pronouns, are written as any other tonal pair, with the presence or absence of an accent marking the tone differences.

The review lessons continue to reinforce the mapping of tone to diacritics. The first two review lessons (5 and 10) include tone drills with the learned words arranged in columns according to the tone pattern of the word in isolation. These words include the affixed forms, in their respective columns. Later review lessons may or may not include a tone drill as a focal point, but tones are written on all syllable drills.

Nuhúnhón 4 ɔ, ɔ



busɔb bua Báláná
 busɔb
 sɔb
 sɔ
 ɔ

1

| | | |
|----|----|----|
| ɔ | ɔ | ɔ |
| sɔ | bɔ | nɔ |

 2

| |
|----|
| sɔ |
| bɔ |
| nɔ |

3

| | | |
|----|----|----|
| sɔ | bɔ | nɔ |
| sa | ba | na |

 4

| | |
|------|----|
| bɔ́ | ná |
| bóná | |

Wɔ́bóná.

5

| |
|-----|
| bɔ |
| bɔ́ |
| bɔ́ |

| | |
|---|---|
| ɔ | ɔ |
|---|---|

16

Figure 7. Elip built word drill (Bábaóga & Bédiléne, 2009, p. 16)

This primer has three major strengths: the initial lessons that focus on tone; the frequent use of tone drills, marked by the log drum drawing; and the introduction of specifically grammatical tonal minimal pairs in the grammar exercises. However, the use of accents in the synthesis, identification and contrast drills, while being a positive step, is insufficiently frequent for learners to really pay attention to the tone when all the tones are simply unmarked. As indicated earlier, unmarked tone is the most difficult aspect of the phonographic correspondences to learn, thus the tendency of students and teachers is to simply focus on the segments, and not on the sound of the entire syllable (which includes tone), while doing the drills when no tones are marked in those drills. Consistent use of an acute accent to mark H tone on the focus syllable of the keyword in drills, whenever it occurs, would be an improvement, forcing the students and teacher to pay attention to more than just the new letter.

2.3.1.2 *Mmala*

The Mmala primer (Obiono et al. 2009) uses the same method for the initial tone lessons as Elip. Three lessons are then devoted to teaching useful sight words and phrases before the segments are taught. These sight words and phrases are used solely for early key sentence construction. Vowel letters are taught before consonants, with each vowel lesson including a tone drill indicated by a drawing of a log drum. The first review lesson for the vowels, however, does not include tone drills, although it does include CV syllables that have not been explicitly taught. It also includes several short stories, most of which are illustrated.

The first ten consonant lessons and their review lessons all include tone drills, which until lesson 13 are simple syllable comparisons. After that, the tone drills involve words or phrases, but not in every consonant lesson. Some of the word pairs are the same as in the pre-lessons. The review lesson tone drills, which start at the end of the vowel lessons, consist of learned words arranged in columns according to tone pattern (Figure 8).

Major strengths of this primer are the all-but-consistent use of tone contrast drills in the segment lessons, as well as the tone pattern comparison drills in the review lessons. However, the synthesis, identification and contrast drills never include tone marks; this might lead students and teachers to think of unmarked syllables as tonally neutral instead of as L tone. Grammar drills for tonal minimal pairs are also lacking. Going by the French translations¹⁵ at the end of the primer, which do not fully correspond to the current contents, it seems that in an earlier version of the primer (used by some of the participants in our experiment) some of the words in the review lesson tone drills may have included grammatical tonal minimal pairs, but these have apparently been eliminated.

2.3.1.3 *Yangben*

The Yangben primer (Kibassa, 2010) uses a double bell picture to indicate that students need to be listening for tone. The initial tone lessons in this primer focus on words that have the same tone pattern rather than on tonal minimal pairs. Words with the same tone pattern are presented in one column, while those with another are in a second. Arrows make the teaching order clear: words having the same tone pattern are learned first, then, after both columns have been read, tone patterns are contrasted by reading horizontally. No tonal minimal pairs appear in these exercises (Figure 9).


After the names of the primer story characters are introduced as sight words, segments are taught (a mix of consonants and vowels). Every letter lesson has a tone drill, usually just a syllable.


15. Translations into French or English, depending on the region of the country, are required in Cameroonian vernacular publications.


Ḡḡḡḡḡḡ ḡḡ 15 (Gionsigonyo 11-14)

| | | |
|----|----|----|
| nu | na | ne |
| du | da | de |
| mu | ma | me |
| bu | ba | be |

Nuyá ná Babá nye bunḡḡ.
Ḡedan nye agá onḡḡḡ.
Uḡúnánḡ agá ḡisumb ḡḡ madéḡḡ.
Nebemb ḡúnánḡ agá madéḡḡ.



| | | | |
|---|----------------------------------|---|----------------|
|  | ḡedan ḡisumb bunḡḡ andḡ | nuyá agá ḡeḡḡs babá iná Bumbuá | onḡḡḡ ḡeḡḡḡ |
|---|----------------------------------|---|----------------|



38

Figure 8. Mmala review lesson (Obiono et al., 2009, p. 38)

Only the first and last of the four review lessons include tone drills. The first contrasts identical single and double vowel syllables. The last lesson includes three sets of tonal minimal pairs, where learners are asked to draw a line from the word to the correct drawing that illustrates it.

Introducing tone marks by focusing on tone patterns is a strength of this primer, as experience indicates that word-level tone may be more salient to speakers than syllable-level tone. Another strength is the inclusion of a tone drill in every lesson teaching a new letter. The omission of tone drills from the second and third review lessons is surprising, as is the lack of grammatical tone contrasts. This primer shares a weakness of the Mmala primer in that none of the synthesis, identification or contrast drills include tone marks.

Mfóóŋ 1












| | | | |
|---|--|---|---|
| _ _ |  | _ / | |
| | | | |
|  1 ↓ aŋual | 3 →  2 ↓ níkán |  eful |  oŋók |
|  eŋis |  aŋól |  oyo |  tukúny |
|  aŋbək |  yəpəp | | |
| 5 | | | |

Figure 9. Yangben tone awareness drill (Kibassa, 2010, p. 5)

2.3.2 Transition guides

The three transition guides described and reviewed here teach and practice tone differently. Yangben follows the best practice recommendation of introducing tone very early, while the two others introduce letters common to French and the respective language first. All three guides include exercises for both the reading and writing of tone, but only the Yangben guide consistently reminds its readers of the importance of tone when reading and writing. Although all three languages have grammatical tone (see pp. 174–177), only the Elip and Yangben primers discuss it, in both cases at the end in a section on orthographic rules. All three guides provide reading texts at the end for practice; Mmala and Yangben also include a writing exercise where knowledge of tone marking can be applied.

2.3.2.1 *Elip*

The Elip transition guide (COLANUL, 2012) introduces the alphabet in lesson 1, and teaches tone in lesson 4. It gives a brief description of what a tone language is, along with a description of what the voice does when pronouncing a tone. It also identifies the number of tones in Elip and specifies how they are represented in the orthography. Then the guide gives a tonal minimal pair, with drawings to ensure proper identification, as an example (Figure 10).

After three reading and writing exercises, the guide adds an explanation of rising and falling tones. These are written with two vowels, with an acute accent representing H written on the appropriate vowel to obtain the proper pattern. A single example contrasting a word with a level tone and another with a rising tone is presented, before two more exercises are given. A reading exercise follows, where words with rising and falling tones are grouped and identified by their pattern, and then a writing exercise. Although Elip has fairly mobile tone, and although the orthography tends to maintain consistent word images, it is never specified if tone is written only as it sounds on words in isolation, or as it sounds in connected speech. All exercises in the tone lesson involve isolated Elip words.


The preface of the Elip transition guide does not specify whether this guide is to be used in a class or independently. However, it does encourage the learner to

Leçon 4

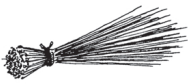
Le ton haut et le ton bas

Le nulíbie, comme toute langue bantoue, est une langue à tons. Les langues à tons sont celles dans lesquelles la hauteur de la voix sert à distinguer les mots. Le nulíbie possède deux tons de base : le ton haut et le ton bas. On parle du ton haut lorsque la voix monte pendant la prononciation d'un son et d'un ton bas lorsque la voix descend.

Le ton haut est noté [´] au-dessus de la lettre qui le porte. Par convention, le ton bas n'est pas du tout marqué.



usag



uság

Lisez à haute voix les deux mots ci-dessus. Notez que la seule différence dans la prononciation des deux mots est au niveau du ton. A l'écrit aussi, la différence se voit dans le marquage du ton.

Figure 10. Introduction to tone in the Elip transition guide (COLANUL, 2012, p. 12)

write directly in the book. This, along with the presence of answers to the exercises in the back of the book, indicates that it may be used as a self-teaching tool. A major strength of the guide is the separate lesson on tone, with an explanation not only of level tones but also of rising and falling tones.

Unfortunately, this guide has a number of weaknesses, especially as a self-teaching book. In the first lesson, the authors note that readers will see accents that they can basically ignore until lesson 4; learners are expected to base their reading on the French translations given in the examples, a common strategy in transition guides. However, prior to lesson 4, a number of writing exercises where students have to write accents are given, including Elip to French translations. This violates the educational principle of sequencing, particularly for adult learners who need careful progression of learning tasks in order to feel capable of success (Vella, 2002, p. 101). It would perhaps have been better to limit learning tasks to reading exercises until after the teaching of tone – or even better, to have followed Kutsch Lojenga's (1989, p. 33) recommendation to start the transition guide with the tone lesson.

The tone lesson itself has a major weakness, namely the paucity of examples before requiring that students do exercises. A single example is insufficient preparation for independent work, especially given the difficulty of developing tone awareness in European-language literates (Bearth, 1977, p. 1; Hunter, 1994, p. 10; Kutsch Lojenga, 2014, p. 71). In fact, in the entire lesson on tone, only two minimal pairs are given as examples, one for level tones and one for the rising tone. This means that most learners are unlikely to master the concept of tone, and will thus continue to depend on French translations to pronounce the reading exercises correctly, and to guess where to put accents when doing the writing exercises. A better approach would have been to include more tonal minimal pairs (with all possible patterns) as examples, and then include sentences using those pairs as Kutsch Lojenga (1993, p. 18) recommends. Lesson 4 could also be moved up to follow the lesson on the known vowels, as accents are already familiar to French readers, albeit with different values. It would also have been helpful if learners were reminded to write the tones in all the writing exercises, not just for lessons 4 and 5; and even better if they had been encouraged to whistle or hum the tones for the words before writing them in lessons beyond lesson 4. Regrettably, no examples of grammatical tone are included in the transition guide.

2.3.2.2 *Mmala*

The Mmala transition guide (COLANUM, 2009) begins by introducing the alphabet, then teaches tone in lesson 5. This lesson states that all words in Mmala are pronounced with a specific tone pattern and that some words are only distinguished from others by their tone. It then notes that Mmala has two tones, and that H is

EXERCICE 1 : Lisez les mots suivants à haute voix en allant de la gauche vers la droite. Remarquez la différence des tons entre les paires des mots dans la prononciation et à l'écrit.

- | | | | |
|-----------|-----------------|------------|----------------|
| 1. gisas | <i>poitrine</i> | 7. gisás | <i>carpe</i> |
| 2. nibana | <i>pas</i> | 8. nibána | <i>mamelle</i> |
| 3. buóli | <i>travail</i> | 9. buolí | <i>filet</i> |
| 4. gueleb | <i>élever</i> | 10. guéléb | <i>noircir</i> |
| 5. malaŋ | <i>parures</i> | 11. maláŋ | <i>membres</i> |
| 6. gubaŋa | <i>pleurer</i> | 12. gubáŋá | <i>égrener</i> |

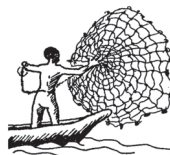


Figure 11. First tone exercise in the Mmala transition guide, with tonal minimal pairs (COLANUM, 2009, p. 15)

marked with an accent since L is more frequent. The lesson then proceeds to exercises. The first, a reading exercise, is composed of tonal minimal pairs, with French translations to aid the learner (Figure 11). The second exercise requires students to fill in boxes with the correct French or Mmala word, which they can do correctly by referring to the previous exercise. The third exercise asks students to read a proverb aloud and then write the French translation. The fourth merely asks students to read two phrases and underline the words having H tone. Nowhere is it specified if words are written as in isolation or in context, even though Mmala, like Elip, has a fairly mobile tone system.

Like Elip, the Mmala transition guide does not specify in its preface whether it is intended to be for classroom use or a self-teaching guide. However, it does encourage students to go through the lessons sequentially and to write in the book, which implies that it can be used for self-teaching. In that light, the Mmala transition guide has a number of significant weaknesses. Foremost among them is the placement of the lesson on tone, which follows not only the known letters, but also the lesson on a letter unfamiliar to readers of French, <ŋ>. Since accents are known symbols for French readers, the tone lesson should ideally be placed prior to the lesson introducing a previously unknown symbol, following the learning principle of known-to-unknown (Davis, 2014, p. 20; Hunter, 1994, p. 15). Additionally, no mention of the accents on words used in lessons 1–4 is given, yet certain answers to the writing exercises in lessons 1 and 3 require the use of accents.

The lesson on tone also has several important weaknesses. First, no examples are given prior to the exercises to help develop tone awareness. While for exercise 1 two drawings represent words on the list (<gisás> carp and <buolí> net), they are not a tonal minimal pair, so it is unclear what pedagogical purpose they serve (Figure 11). The exercises themselves are doable, but the answers to exercise 4 are incomplete, which could lead students to believe that they had incorrectly identified several H tone vowels. Additionally, in Mmala, adjacent vowels, whether identical or not, may have different tones, but no mention is made of this in the description of tones or tone patterns to guide learners in their writing or pronunciation.

2.3.2.3 Yangben

The preface to the Yangben transition guide (Kibassa, Okuno, & Pianga, 2015) has the same explanation about its use as the Elip and Mmala guides. However, its overall structure has important differences. In the preface, the lesson format is explained, with most lessons having a keyword and a drawing. The tone lesson is located immediately after the presentation of the alphabet. Every lesson ends with the reminder (signaled by a drawing of a crowing rooster) that when the tone is not read correctly it changes the meaning of the word. A tonal minimal pair with translations, but not drawings, is given to highlight that fact (Figure 12). Each lesson ends with a proverb. Lesson 13 discusses orthography rules. This section also specifies that the tones should be written as the word is pronounced in isolation. Additionally, the minimal tone difference between near past and distant past is shown. This guide ends with a number of reading exercises, some translation exercises (into French) and one writing exercise, providing a good synthesis of all the rules.

RETENONS !
Un ton non-respecté change le sens d'un mot.

| | |
|--|-------------------------------|
| nuumú <i>groupe de travail</i> | núúmu <i>gloire</i> |
|--|-------------------------------|

Aḡalá tiom muón ɔmfion.
Le rat zébré ne refuse pas le zébrage à son petit.

Pa ni nséti ki mbalá !
Attention !




Figure 12. An end-of-lesson reminder of the importance of tone in the Yangben transition guide, with accompanying proverb (Kibassa et al., 2015, p. 37)

While the Yangben transition guide is designed for those who already read and write French, it frequently uses drawings as vocabulary supports. This is an excellent strategy when users are somewhat weak in their French reading and writing ability and need the visual support for word recognition (Adams, 1990, pp. 366–367), and additionally helps learners pronounce words with the proper tone pattern, even if they are uncertain of the French translation. Another major strength of this guide is the final section of each lesson which reminds learners to pay attention to the tone marks when reading. However, the fact that this section is also at the end of lesson 1, before tones have been introduced, is unfortunate. Finally, the last lesson's explanation of how to write lexical and grammatical tone, with its reading exercises and a writing exercise, is clear and a real asset to the guide.

PART 2

Tone orthography and literacy outcomes

The tone orthography experiment design (*David Roberts, Stephen L. Walter*)

1. Introduction

Our experiment design broadly follows Bird (1999, pp. 95–97) but differs from it in several respects. In this chapter we describe our adaptation of it, focusing on the text corpus (Section 2), the sample (Section 3), the tasks (Section 4), the scoring procedure (Section 5), the statistical analysis (Section 6), and the independent variables (Section 7). We also address the question of experimental group equivalence (Section 8).¹

2. Text corpus

We translated the four Dschang narrative texts from Bird's own English translation (1999, pp. 111–114) into YORUBA² and French, and then from French into the nine other focal languages. The texts – labeled SQUIRREL, EXILE, SORCERY, and PANTHER – were of similar style and difficulty, and were varied in their lexical content. We verified that they were in harmony with the respective focal language cultures and in a few cases found it necessary to change small details. For example, in the Ife translation of the PANTHER text, it was a hare rather than a pig that rescued the monkey from the panther, because in Ife culture the pig is not considered to be a crafty animal.

In general, we considered naturalness to be a higher translation criterion than accuracy. To this end, we employed the following oral translation method, where *A* = the researcher; *B* = a trained, literate L1 speaker who is bilingual in the official language; and *C* = a naive L1 speaker.

1. All the experimental data is available online at the following address: <https://doi.org/10.1075/swll.18.additional>

2. From this point onwards, experimental variables are written in small capital letters for ease of identification.

- *A* read the text to *B* in the official language;
- *B* related the story back to *A* in the official language;
- *A* corrected any factual mistakes;
- *A* read the text again to *B* in the official language, and they discussed any words *B* was unsure of;
- *B* related the story aloud in the local language and this rendering was recorded;
- *B* transcribed the recording and provided a rough back translation;
- *A* and *B* discussed the transcription, adding any missing information and correcting spelling;
- *B* read the written translation to *C*;
- *C* made comments on the naturalness of the translation;
- *A* asked *C* some comprehension questions about the text in the official language;
- *B* revised the written translation where necessary.

How stringently this oral translation method was implemented in each location depended on *A*'s knowledge of the language and *B*'s level of experience as a translator. Once the written translation was completed, spelling – especially of tones – was checked and rechecked independently by an experienced linguist and/or literacy worker.

In each focal language, two “booklets” were prepared, each containing the four texts, half with ZERO TONE marking (Z), and half with FULL TONE marking (F), the latter being the standard orthographies of the ten focal languages. Both booklets contained the same texts, but differed in terms of which texts were marked for tone: one presented the texts in the order Z1, Z2, F3, F4; the other in the order Z3, Z4, F1, F2. The four texts were also prepared separately with interlinearized morpheme-by-morpheme glosses for the researchers' use. A fifth text – labeled SCORPION – was prepared in the official language (English in Nigeria; French elsewhere), deviating from Bird's (1999) design which did not include an L2 oral reading task. Because of the oral translation method, the texts differ considerably in length from language to language but performance data was not examined for any potential variation in text length.

3. Sample

A total of 308 adults participated in the experiments for payment. In each location, administrators – who were mostly experienced literacy workers – were encouraged to send their most competent readers, so participants were not randomly selected from the total populations of literate L1 speakers of the focal languages. The sample

was also assembled more haphazardly than we would have liked, since the researchers often relied on local contacts to identify suitable people before their arrival. In many cases, when those invited could not attend, they sent someone else in their place; others brought along a friend; still others heard about the event by word of mouth. We turned nobody away solely on the basis that they were uninvited, because we wanted to harvest the maximum number of recordings.

Participants were informed that the purpose of the experiment was to test the orthography itself, not their own reading and writing ability. However, they were not specifically told that the focus of the experiment was on tone. All of them had already been taught to read full tone marking in the standard orthographies of their respective languages, and had had opportunity to practice. Strong and weak readers were included, but anyone who was unable to read more than one word at a time without long pauses between each word was excluded.

4. Tasks

4.1 Introduction

Since the research was conducted in several countries and at different times, special care was taken to standardize procedures. Each researcher ran their experiment in close and regular consultation with the principal investigator. Each experiment lasted two or three days, preceded by a training session for the administrators. The experiments were conducted using only the L1. In each location, at least one of the researchers was discreetly present to ensure that it ran smoothly. The experiments consisted of the following tasks: L1 and L2 oral reading (Section 4.2); answering oral reading comprehension questions (Section 4.3); and a writing exercise that consisted of adding diacritics to the unmarked versions of the texts (Section 4.4).

4.2 Oral reading

The L1 oral reading task followed Bird's (1999, pp. 96–97) within-subject design, i.e. one in which all participants were exposed to both conditions: ZERO TONE and FULL TONE. Participants were randomly assigned to one of two experimental groups according to the order in which they read the four L1 texts, and this was tracked in the GROUP variable (Group 1: Z1, Z2, F3, F4; Group 2: Z3, Z4, F1, F2). However, it would have been impractical to attempt any strict matching of the demographic profiles of these two groups, because we only had direct contact with

the participants for two or three days in each location, and were gaining demographic information in tandem with administering the reading and writing tasks. Instead, we shuffled the two versions of the texts and issued them randomly to each consecutive participant. For a verification of GROUP balance, see p. 207. For further discussion of the challenges of achieving randomization in the context of a developing country, see Ralaingita & Wetterberg (2011, p. 99).

Bilingual participants were also recorded orally reading the fifth, L2 text. No participant had the opportunity to preview any of the texts beforehand, either by reading them or hearing them read. Participants were not allowed to read the texts silently before starting to read aloud. The administrator did not interrupt any performances. Performances were recorded either in *Audacity*³ or in a format that could easily be imported into this program for scoring purposes. After the oral reading of each text, the administrator asked the participant whether they had any prior knowledge of the story and this information was captured in the FAMILIARITY variable.

4.3 Comprehension questions

Bird (1999, p. 97) measures comprehension by means of an L1 speaker reviewing the recordings and judging "... whether each tone error resulted in a different interpretation of the word or of the grammatical construction." The author later acknowledges this conflation of accuracy and comprehension as a design weakness and encourages future experimenters to include separate tasks that specifically target comprehension (p. 103). Accordingly, we drafted three comprehension questions per text and translated them into each of the focal languages, making a total of twelve questions for the L1 texts, plus three more for the L2 text.

After each oral rendering, the administrator retrieved the text and three comprehension questions were asked. All the questions were asked and answered using the focal language, including those about the L2 text. All questions and answers were spoken and recorded; no writing was involved.

On leaving the recording room, participants were told not to inform anyone of the content of the texts. Each participant session, from beginning to end, took between 25–50 minutes.

3. Audacity^{*} is free, open source, cross-platform audio software for multi-track recording and editing (<http://www.audacityteam.org> accessed 26 January 2021).

4.4 Tone writing

Following the recording session, each participant was directed to an adjoining room for the tone writing task. This consisted of marking tone diacritics on the two ZERO TONE versions of the texts in their personal booklet as accurately as possible within a time limit of twenty minutes (Bird, 1999, pp. 96–97; and cf. Piper & Zuilkowski, 2015, p. 93) The task was performed with pencils and erasers, permitting participants to correct their work when necessary. Participants worked alone and were supervised but given no help.

5. Scoring

5.1 Introduction

In July 2015, the principal investigator led a scoring workshop in Kara, Togo, attended by the administrators of the five Togolese and Beninese languages (IDAASHA, MBELIME, NATENI, IFE, TEM). This was followed by a similar event in Côte d’Ivoire in September 2015 for EASTERN DAN. The researchers in Nigeria (YORUBA) and Cameroon (ELIP, MMALA, YANGBEN) scored their results in their respective locations, trained and supervised remotely by the principal investigator to ensure that the data were collected and measured in a uniform way. Where possible, we reduced the possibility of scoring errors by having two trained scorers confer. Scorers evaluated recordings without knowing whether they were treating ZERO TONE or FULL TONE versions of the texts. In fact, in experiments of this nature it is perfectly possible for a trained administrator to time the performances and score the comprehension results during the live performances. But for our purposes, given the unusually wide geographical distribution of administrators, we considered it prudent to tackle scoring these measures afterwards to ensure adequate supervision in a more relaxed environment.

A single Excel file was prepared for each focal language into which all the performance data was entered, with separate spreadsheets for oral reading speed, accuracy, comprehension, and writing accuracy. Administrators were given detailed written and oral instructions that they were required to follow meticulously and impartially. Occasionally, where the scoring procedure revealed that a word had been incorrectly marked for tone in the experiment corpus, the orthographic TBU in question was excluded from the final scores.

5.2 Oral reading speed

Oral reading speed is often measured in terms of “words per minute (wpm)” (e.g. Good & Kaminski, 2002; Wiederholt & Bryant, 2003), but others use “words correct per minute (wcpm)” (e.g. Fuchs et al., 2001, p. 240; Schall et al., 2016, p. 262), “seconds per correct word” (Jenkins et al., 2003, p. 722), “words correct per second” (Malda et al., 2014), or simply the time taken to read a passage (Hudson et al., 2005, p. 704). As for Bird (1999, p. 97), he uses “time taken to read 100 words measured in seconds”.

We considered none of these alternatives to be appropriate for our own series of experiments because of its cross-linguistic nature. As Graham & van Ginkel (2014) point out, African languages often have different phonotactic, morphological and orthographic structures both from each other and from European languages (see also Piper et al., 2016, p. 136; Spaull et al. 2020, pp. 3–4). Since in our own study word length varies from language to language, we were faced with a measurement challenge. After experimenting with graphemes per minute, and in view of the central importance of tone to our study, we eventually chose orthographic TBUs per minute (and syllables per minute for the non-tonal L2 texts). Having made the decision to adopt a unit smaller than the word, we found ourselves in good company; cf. research on English (Stone et al., 1999, p. 15), Machiguenga (Davis, 2004, pp. 44–45), Thai (Vitrano-Wilson, 2016, p. 239), Turkish (Pierce, 1960), and two cross-linguistic studies (Coupé et al., 2014, p. 1; Trauzettel-Klosinski & Klaus, 2012, p. 5457).⁴

Administrators were trained to time the L1 and L2 oral reading performances in seconds from the moment the participant began to read aloud to the moment they stopped. Timing excluded perception time, rare external interruptions (such as a cell phone ringing) and the comprehension task. Raw scores measured in seconds were entered in Excel and then converted into orthographic TBUs per minute. Table 1 lists the performance variables associated with oral reading speed.

Table 1. Performance variables associated with oral reading speed

| | |
|----------|---|
| L2 SPEED | Oral reading speed of the L2 SCORPION text measured in syllables per minute. |
| L1 SPEED | Oral reading speed of the four L1 texts measured in orthographic TBUs per minute. |

4. Both papers focus on reading performance. Coupé et al. (2014) compare Cantonese, Finnish, French, Japanese, Korean, Mandarin, Serbian, and Thai. Trauzettel-Klosinski & Klaus (2012) compare German, Arabic, Chinese, English, Finnish, French, Hebrew, Italian, Japanese, Dutch, Polish, Brazilian Portuguese, Swedish, Slovenian, Spanish, Russian, and Turkish.

5.3 Oral reading accuracy

To score oral reading accuracy, the text itself was reproduced on line 1 of an Excel spreadsheet with each orthographic TBU occupying its own column. Each participant, listed in alphabetical order, was assigned two lines. Administrators listened to each participant's recordings at least twice. The first time they scored all error types (consonants, vowels and tone; henceforth "general errors") on participant line 1; the second time they scored tonal errors alone on participant line 2. So, for each orthographic TBU, a deliberate choice had to be made about whether a previously identified general error was, or contained, a tonal error. Each general and tonal error was scored in a single cell with a potentially unlimited upper limit.

Errors were defined as repetitions, substitutions, omissions or insertions, with no attempt to distinguish between these. A word was counted as an error even if it was followed by a self-correction. If an entire phrase was repeated once, each orthographic TBU in that phrase was scored as having one general error. A segmental substitution with the correct tone was counted as a general error. A tonal error with the correct segments was counted as both a general and a tonal error. Insertions were scored in the following column. When the administrator recognized a substitution as being faithful to the participant's dialect and the meaning, it was not counted as an error. Raw totals were calculated, and then, to make them comparable cross-linguistically, converted into percentages, i.e. the total number of errors as a percentage of the total number of orthographic TBUs in the text.

Our scoring method broadly followed Bird (1999, p. 97), but differed from it in four respects:

- Errors and comprehension were measured separately;
- General errors and tonal errors were counted separately;
- Hesitations were not counted as errors unless they were vocalized;
- Average scores were calculated per 100 orthographic TBUs, rather than per 100 words, for the reasons already stated (see p. 196).

Table 2 lists the performance variables associated with oral reading accuracy.

Table 2. Performance variables associated with oral reading accuracy

| | |
|-------------------|--|
| L2 ERRORS | Oral reading errors of all types on the L2 SCORPION text per 100 syllables. |
| L1 GENERAL ERRORS | Oral reading errors of all types on the four L1 texts per 100 orthographic TBUs. |
| L1 TONAL ERRORS | Oral reading tonal errors on the four L1 texts per 100 orthographic TBUs. |

5.4 Oral reading comprehension

To score oral reading comprehension, the administrator listened to the recordings and awarded one point for each correct answer. Table 3 lists the performance variables associated with this measure.

Table 3. Performance variables associated with oral reading comprehension

| | |
|------------------|--|
| L2 COMPREHENSION | Correct answers to three questions following oral reading of the L2 SCORPION text. |
| L1 COMPREHENSION | Correct answers to three questions per text following oral reading of the four L1 texts. |

5.5 Writing accuracy

To score tone writing accuracy, on each Excel spreadsheet, the header line contained the master version of the FULL TONE texts with each orthographic TBU occupying a single column. Underneath this, we assigned two lines for each participant. We copied and pasted the text onto participant line one, and carefully edited the diacritics to match the first participant's handwritten rendering. On participant line two, we entered Excel equivalence formulas.⁵ The penultimate column calculated raw scores; the final column calculated scores as a percentage of those treated. We repeated the same procedure for each participant in successive pairs of lines. Participants were scored up to the last diacritic they added and no further. The writing task could be scored by any trained assistant, whether or not they were an L1 speaker, because it simply required matching the observed data against the expected data.

Scoring the writing task threw up a measurement challenge. A previous experiment had already alerted us to the danger of lumping together all scores for written accuracy (Roberts, Snider, & Walter, 2016, pp. 128, 132). Full tone marking always leaves one tone unmarked (typically L tone in a two-tone language and M tone in a three tone language),⁶ so very different choices are involved on the part of the

5. For example, for the first orthographic TBU of the first participant: “= IF(A2 = A1;1;0)”, i.e. If the contents of cell A2 exactly match those of cell A1, score ‘1’; if not, score ‘0’.

6. With two exceptions. Firstly, EASTERN DAN is a five tone language that, at the time of the experiment, left M tone and the non-initial orthographic TBUs of polysyllabic words unmarked. Secondly, MBELIME is a three tone language that, at the time of the experiment, left L tone unmarked.

writer. Marking a diacritic that should be marked is always a conscious choice. But not marking a diacritic that should not be marked is more ambiguous: it may be the result of boredom, fatigue, or indecision (cf. Bird, 1999, p. 101). An overall score combining these two skills would present at best a blurred picture, but separating them is not much better, because a variable measuring “Not marking a diacritic when it was supposed to be unmarked” would reward participants for writing nothing. In a two-tone language in which H and L tones are equally distributed, a score of 50% would be achieved by handing in a blank piece of paper. Hence, after testing various options, we eventually decided to only include the variable that measured marking a diacritic that should be marked.

For the writing task, unlike the others, it was unnecessary to set up separate performance variables for each L1 text, because the GROUP variable takes care of this: GROUP 1 annotated the SQUIRREL and EXILE texts; GROUP 2 annotated the SORCERY and PANTHER texts (Table 4).

Table 4. Performance variable associated with L1 tone writing accuracy

| | |
|-----------------|---|
| L1 TONE WRITING | Correct choices made by marking a diacritic on the ZERO TONE versions of two L1 texts as a percentage of orthographic TBUs treated. |
|-----------------|---|

6. Statistical analysis

6.1 Previous research

Tone orthography experiments prior to the turn of the century (Badejo, 1989; Essien, 1977; Klem, 1982; Mfonyam, 1989) tend to be limited to reporting averages. One of the most important contributions that Bird (1999) made to the field, quite apart from his experimental findings, was in using, for the first time, a rigorous statistical methodology which tracks, among other things, the impact of variables on the object of interest, the statistical probability of the effect, and the amount of variance accounted for. Most published experiments on African orthographies since then have followed Bird’s lead (e.g. Bernard et al., 2002; Roberts et al., 2019; Roberts & Walter, 2016), and the present series of experiments is no exception. It will therefore be useful to summarize some basic statistical notions for any readers who have no formal training in this domain.

6.2 Basic statistical notions

Statistics can be understood as a set of constructs, models, symbols and procedures for both generating and interpreting quantitative data describing some feature of natural and/or human experience. It provides a tool for identifying the normal profile of a particular phenomenon, and a set of procedures for determining when change has reached the point that the profile must now be described as non-normal, or extraordinary.

We used the Stata software package⁷ to test the impact of all independent variables on performance. The quest is for a parsimonious model, that is, the one that contains the fewest variables needed to explain the largest amount of variance in the data, the fewest residuals (that is, the amount of unexplained variance) and the least probability that the observed outcome occurred by chance (the p value).⁸ When a p value drops below the set threshold, it is said to be statistically significant, meaning that the level of change in the phenomenon of interest is so great that it must be due to the impact of the variable in question. We will also refer to “model fit”, that is, the extent to which a given model explains the data.

In the construction of such models, one needs to navigate carefully between removing variables which appear to be only mathematical artefacts and not removing those which are either plausible or which have explanatory value even though their presence is unexpected. The claim that a model is parsimonious is based not on any set of clear-cut rules, but on the analyst’s judgment and intuition about the phenomenon under analysis.

Our strategy was to start with a single highly significant variable and then comprehensively test all possible combinations of the next added variable, repeating the process until adding new variables did little to improve the predictive power of the model.⁹

7. Version 15. www.stata.com (accessed 26 January 2021). We also used Minitab in the early stages of the analysis www.minitab.com (accessed 26 January 2021).

8. We set the probability threshold at $p \leq 0.05$, although we will also draw attention to results at the $p \leq 0.10$ level in view of the exploratory nature of our research.

9. It is more common to start with a maximally expanded model, iteratively deleting the least statistically significant variables and stopping this process once there are no remaining non-significant variables. We rejected this approach on the basis that, in a research design with many overlapping variables, it is more likely to lead to the deletion of a significant variable that should have been kept.

6.3 Multilevel modeling

Although our design is modeled closely on Bird's (1999) Dschang experiment, it differs from it in one fundamental respect: participants come from one of ten linguistic communities rather than just one. This nesting of the data therefore required two levels of investigation: In addition to whatever individual variation in ability there might be, membership of a given linguistic community may also govern performance, and this, in turn, may concern the linguistic and orthographic profile of the language itself, and/or the ethno-literacy profile of the language community. Either way, such variables operate at the language level and are identical for every participant within a given language.

These considerations led us to choose multilevel modeling (Rage-Hesketh & Skrondal, 2008; Robson & Pevalin, 2016; West et al., 2015) to probe the relationships between predictor and performance variables. A multilevel model is one in which participants (level 1) are naturally grouped into two or more social groups (level 2).¹⁰ Within one group, they may have experiences or acquire skills that are similar to each other and different from those in another group, and group affiliation may impact responses to a given stimulus. A multilevel analysis takes into consideration the influence on level 1 units of the level 2 units into which they are nested when estimating the influence of independent variables. The literature recommends that multilevel models include at least 30 level 2 units before one can be confident in the validity of any effects ascribed to the impact of variables (Maas & Hox, 2005), whereas our dataset contains only ten level 2 units. Some caution will therefore need to be exercised when interpreting the statistical models.

6.4 Accounting for Eastern Dan

From the beginning of the research project, we knew that the linguistic and orthographic profile of EASTERN DAN was markedly different from that of the other focal languages. It is the only language with more than three phonemic level tones (it has five); it has the highest number of dialect variants (it has at least 20); and it is the only representative of its linguistic family (it is a Mande language). It also has the only orthography that, at the time of the experiment, was not using superscript diacritics to mark tone (it was using word-initial and -final punctuation).¹¹

10. In the literature, any analysis that investigates more than one level is usually referred to as a multilevel analysis even when, as is the case with our series of experiments, there are actually only two levels.

11. Since the experiment, the orthography has been reformed in favor of superscript diacritics (Roberts et al., 2019; Vydrin et al., 2019; Zeh, 2018).

Socially, the EASTERN DAN sample was also unusual, having the oldest average age and relatively low levels of formal education. Neither could we ignore the fact that the literacy program was wracked by two civil wars in the fifteen years prior to the experiment.

It came as no surprise, then, to discover that EASTERN DAN performance was often markedly different from that of the other focal languages, and obviously there was some uncertainty as to whether this was due to the above listed factors. The fact that the experimental design had relatively few level 2 units (10) forced us to confront the question of whether the statistical models accounting for performance on the various metrics of L1 reading and writing performance might be distorted by one level 2 outlier. Accordingly, we investigated all the models presented in Chapters 11–15 in such a way as to determine how much distortion is introduced by the exceptional EASTERN DAN data and whether the model presented retains its validity if they are removed from the data set.¹²

7. Independent variables

Twenty-seven independent variables were included in the statistical analysis. Twelve of these operate at level 1, describing the demographic and literacy background of individual participants (Section 7.1), while the rest operate at level 2, with five having to do with the linguistic and orthographic profile of the language (Section 7.2), and ten providing information on the educational and literacy history of each language community (Section 7.3).¹³

12. Readers may question why we did not also investigate the dataset excluding YORUBA, since this group is a social outlier. But YORUBA is not exceptional linguistically or orthographically, and performance, as we will see, was rather ordinary except on the measure of reading speed. Similarly, it was not worth investigating the dataset excluding YANGBEN even though, as we will see, this group scored worst on three of the five measures, because this group is not a social or linguistic outlier and in any case the sample was too small to have any chance of distorting the statistical models.

13. More detailed information about the independent variables can be found in the Appendix (p. 307).

7.1 Demographic variables (Level 1)

Level 1 data about the demographic profile of the participant were gleaned by means of a questionnaire filled in by the participants.¹⁴ Bird (1999, p. 95) gleans five demographic variables (Age, Gender, Education, Employment, and L1 literacy experience); our questionnaire expanded this list to twelve (Table 5). On the other hand, Bird (p. 96) included a questionnaire about orthography use, attitudes to tone marking and self-assessment of tone-marking ability that is absent from our experiment design.¹⁵ Monolingual participants and those with weak L2 skills were interviewed individually by an administrator using the L1, but the responses were still recorded on the questionnaire using the L2. Participants understood that this task, unlike the others, was not being assessed for performance.¹⁶

Table 5. Demographic variables (Level 1)

| | |
|----------------------|--|
| GENDER | Participant's gender. |
| AGE | Participant's age. |
| DIASPORA | How long the participant had lived outside of the L1 homeland, measured in years. |
| PARENTAGE | How many of the participant's parents spoke the FOCAL LANGUAGE as their L1. |
| FIRST LANGUAGE | Whether or not the participant spoke the FOCAL LANGUAGE as their L1. |
| DIALECT | Which dialect the participant spoke and whether that dialect is the reference dialect. |
| EYESIGHT | Whether or not the participant reported having poor eyesight. |
| EDUCATION | Participant's level of formal education, measured in years. |
| L1 EXPERIENCE | Participant's experience reading and writing the L1, measured in years. |
| L1 READING FREQUENCY | Estimated frequency of reading the L1, measured in days per year. |
| L1 WRITING FREQUENCY | Estimated frequency of writing the L1, measured in days per year. |
| FAMILIARITY | Whether or not the participant had prior knowledge of any of the texts. |

14. The L2 was used for the participant questionnaire because an attempt to use the L1 for this task in a previous experiment greatly impoverished the quality of the data (Roberts, 2008, p. 556).

15. This was a methodological oversight on our part. We would encourage future researchers to gather and exploit data of this nature.

16. For READING FREQUENCY and WRITING FREQUENCY, responses to multiple choice questions were subsequently quantified (more than once a day = 730; every day = 365; twice a week = 104; once a week = 52; twice a month = 24; once a month = 12; less than once a month = 6; never = 0). We consider it likely that participants over-estimated their responses to both questions.

It will be helpful to add some brief comments in the case of seven of these variables.

GENDER: Since running the experiments, literacy staff in several of the focal language communities have remarked that the low female turnout was not representative of their programs; on the contrary, L1 literacy classes tend to attract high numbers of women.

AGE: West Africa has a pervasive culture of “judgments”, that is, a document allowing enrolment at primary school in the absence of a birth certificate, which requires negotiating a convenient birth date. This has evolved into a wider practice whereby parents who do know their child’s age can still negotiate an artificial age for them so that they appear younger on official records than is actually the case. This can be advantageous if the child has not started school early, and, later in life, when applying for jobs that have an age limit. In our series of experiments, it is certainly possible that the information gleaned from the questionnaire may contain a mixture of real and “judged” ages, but the difference between them is usually only a matter of a few years. Still, future experimenters would do well to frame questions in such a way as to ensure that all ages reported are accurate as far as the participant is aware.

DIASPORA: There remains some doubt about the trustworthiness of the data gathered for this variable, because it does not take into account the fact that long-established communities of L1 speakers may have taken root in distant locations. Therefore, even if the participant claims to have lived outside of the homeland, it may have been in an environment where they were exposed to the L1 all or most of the time. Future experimenters might consider refining the methodology for collecting such data, with a view to drawing finer distinctions between different layers of linguistic experience when away from the homeland.

PARENTAGE: Children in all ten focal language communities inhabit extended families, in which parents do not necessarily have exclusive responsibility for their upbringing. In such a context, many family members may influence a child’s choice of language, so the responses to this question may be of less use than if the same question was asked in a WEIRD society. Future experimenters may do well to frame the question as “How many adults in your childhood home spoke [language]?”

| | |
|------------|---|
| DIALECT: | Collecting reliable data to establish an accurate dialect profile for each participant is arguably the most challenging among all the demographic variables. We made our evaluations on the basis of birthplace, childhood home and current residence. Where possible, administrators verified individual responses through personal acquaintance with the participant. Data were gathered for all the focal languages except YORUBA. In this language, it seemed wise not to attempt to untangle the DIALECT question, because so many of the participants had grown up outside of the homeland and had almost certainly been exposed to other varieties through language contact. |
| EYESIGHT: | This is an important consideration in the African context because many people do not have access to an optician, and could not afford a consultation or prescription even if they did. This variable has proved to be predictive of performance in a previous literacy experiment (Roberts & Walter, 2016, p. 181). |
| EDUCATION: | The number of years spent at school is not necessarily an indication of the grade level reached because in west Africa pupils have to repeat grades if they fail the end of year exams. |

7.2 Linguistic variables (Level 2)

Table 6 lists the level 2 data about the linguistic profile of the language and its orthography.¹⁷ The method for counting diacritic density follows Bird (1999, p. 89).

Table 6. Linguistic variables (Level 2)

| | |
|---------------------------|---|
| FOCAL LANGUAGE | Name of the language |
| NUMBER OF TONES | The number of contrastive phonemic level tones in the focal language (2, 3, 5). |
| OVERALL DIACRITIC DENSITY | The density of all diacritics in the standard orthography of the focal language, expressed in terms of diacritics as a percentage of the total number of orthographic TBUs in the corpus. |
| TONE DIACRITIC DENSITY | The density of tone diacritics in the standard orthography of the focal language, expressed in terms of tone diacritics as a percentage of the total number of orthographic TBUs in the corpus. |
| WORD LENGTH | Average word length in the focal language measured in orthographic TBUs. |

17. We also paid attention to language family membership in the statistical analysis but it was never predictive of performance.

7.3 Ethno-literacy variables (Level 2)

In addition to purely linguistic variables, level 2 also identifies certain variables that have to do with the history, development and practice of literacy in the language community, in other words, its ethno-literacy profile. These data were gleaned by means of a second questionnaire sent to each researcher or literacy program coordinator and this information was organized in terms of the following variables (Table 7).¹⁸

Table 7. Ethno-literacy variables (Level 2)

| | |
|-------------------------|--|
| L1 LITERACY HISTORY | Length of time since L1 literacy was first introduced in the focal language community in a substantial way measured on a 7-point scale. |
| L1 LITERACY PROGRAM | Size of L1 literacy program in the focal language community measured on a 5-point descriptive scale. |
| L1 LITERACY ACTIVITY | Scope and intensity of L1 literacy activities in the focal language community measured on a 6-point descriptive scale. |
| L1 LANGUAGE DEVELOPMENT | Vision, leadership and resources for ongoing L1 language development in the focal language community, measured on a 6-point descriptive scale. |
| L1 LANGUAGE STATUS | Status of the L1 and its use in the focal language community measured on a 5-point descriptive scale. |
| L1 ORTHOGRAPHY STATUS | Status of the L1 orthography, measured on a 5-point descriptive scale. |
| EDUCATION STATUS | Status of formal education in the focal language community, measured on a 6-point descriptive scale. |
| PRIMARY ENROLMENT | Attendance and completion of primary education in the focal language community at the time of the experiment, measured on a 5-point descriptive scale. |
| SECONDARY ENROLMENT | Attendance and completion of secondary education in the focal language community at the time of the experiment, measured on a 5-point descriptive scale. |
| TERTIARY ENROLMENT | Attendance and completion of tertiary education in the focal language community at the time of the experiment, measured on a 5-point descriptive scale. |

18. The questionnaire also asked about levels of primary, secondary and tertiary school enrolment thirty years prior to the experiment, but these were never predictive of performance.

8. Group equivalence

Since participants were not assigned to the two experimental groups by matched random assignment, it is important to investigate with hindsight whether the two groups were in fact balanced.

GROUP 1 had six more participants in it than GROUP 2, but in general the groups were well balanced in terms of FOCAL LANGUAGE representation. Any differences are too slight to be statistically significant (Table 8).

Table 8. Experimental GROUP balance by FOCAL LANGUAGE

| | GROUP 1 (Z1Z2F3F4) | GROUP 2 (Z3Z4F1F2) | p value |
|--------------|--------------------|--------------------|--------------|
| ELIP | 9 | 8 | 0.808 |
| MMALA | 11 | 9 | 0.655 |
| YANGBEN | 8 | 6 | 0.593 |
| YORUBA | 13 | 14 | 0.847 |
| IDAASHA | 16 | 16 | 1.000 |
| IFE | 16 | 15 | 0.857 |
| NATENI | 19 | 21 | 0.752 |
| MBELIME | 17 | 15 | 0.724 |
| TEM | 19 | 19 | 1.000 |
| EASTERN DAN | 29 | 28 | 0.895 |
| TOTAL | 157 | 151 | 0.732 |

We also tested the balance of the two experimental groups in terms of demographic variables. In Table 9, binary variables are expressed as percentages. Multiple category variables were subject to chi-square tests on the overall distribution of all values against GROUP, with only p values being reported. We also tested whether the numerical distribution of each value was equal between the two groups. In such cases, counts as well as p values are given. Count variables were tested for equality of representation by GROUP, giving both the counts and p values. Measure variables were assessed using ANOVA which generates standard deviations and p values. Tests confirm that the two groups were adequately balanced in terms of demographic variables (Table 9).¹⁹

19. In most cases FAMILIARITY is a binary variable when counted across all five texts. In one case, however, a participant reported familiarity with three of the texts. We therefore computed a chi-square based on the number of people who reported FAMILIARITY but Table 9 reports the total number of cases.

Table 9. Experimental GROUP balance by level 1 demographic variables

| | GROUP 1 (Z1Z2F3F4) | | GROUP 2 (Z3Z4F1F2) | | p |
|----------------------|--------------------|-------|--------------------|-------|-------|
| | Value | SD | Value | SD | |
| GENDER (M) | 109 | – | 105 | – | 0.785 |
| AGE | 41.78 | 11.05 | 39.94 | 11.49 | 0.158 |
| DIASPORA | 6.70 | 8.88 | 5.24 | 8.60 | 0.145 |
| PARENTAGE (2) | 129 | – | 128 | – | 0.950 |
| FIRST LANGUAGE | 93.63% | 24.5% | 94.04% | 23.75 | 0.882 |
| DIALECT | 53.91% | 50.0 | 52.07% | 50.2 | 0.772 |
| EYESIGHT (poor) | 23.8% | 42.77 | 26.0% | 44.01 | 0.669 |
| EDUCATION | 8.18 | 4.6 | 8.121 | 4.68 | 0.906 |
| L1 EXPERIENCE | 15.00 | 10.00 | 14.63 | 9.53 | 0.744 |
| L1 READING FREQUENCY | 330.1 | 273.1 | 347.5 | 272.7 | 0.578 |
| L1 WRITING FREQUENCY | 252.0 | 282.6 | 288.0 | 281.2 | 0.268 |
| FAMILIARITY | 16 | – | 13 | – | 0.972 |

The experimental groups were almost exactly balanced in terms of how many participated in the L2 reading task (GROUP 1, 119; GROUP 2, 118). Table 10 reports experimental group equivalence in terms of the three performance variables associated with L2 literacy skills.

Table 10. Experimental GROUP balance by L2 literacy skills

| | GROUP 1 (Z1Z2F3F4) | | GROUP 2 (Z3Z4F1F2) | | R ² | p |
|------------------|--------------------|-------|--------------------|-------|----------------|-------|
| | Mean | SD | Mean | SD | | |
| L2 SPEED | 152.52 | 39.24 | 144.56 | 39.83 | 0.59% | 0.124 |
| L2 ERRORS | 4.69 | 6.73 | 6.00 | 6.73 | 0.51% | 0.140 |
| L2 COMPREHENSION | 2.23 | 0.90 | 1.90 | 0.98 | 2.36% | 0.026 |

GROUP 1 reads the L2 slightly faster, with fewer errors and greater comprehension than GROUP 2, but it is only on the L2 COMPREHENSION measure that the difference becomes statistically significant.

We are now in a position to proceed to the investigation of reading and writing performance with and without tone marks that constitutes the heart of this research. Following a literature review, each chapter will present descriptive statistics to give the reader a general sense of the data, then go on to examine progressively more formal models that offer explanatory insights about the forces giving shape to them.

With this background in mind, we now turn to the results of the multilevel statistical analysis of oral reading speed (Chapter 11), general accuracy (Chapter 12), tonal accuracy (Chapter 13), comprehension (Chapter 14), and tone writing (Chapter 15).

Tone orthography and oral reading speed (*David Roberts, Stephen L. Walter*)

1. Introduction

Reading speed, along with accuracy and prosody, is one of the three observable components of reading fluency (Fuchs et al., 2001, p. 239). It is made up of sub-skills such as speed of sight word recognition; speed of processes used to identify unknown words (e.g. phonemic decoding, use of analogy and guessing from context); and speed of smoothly connecting text (Torgesen & Hudson, 2006, pp. 133–134, 137–138). Unskilled readers differ in the relative importance they give to the different components of fluency. Some performance-oriented readers will instinctively attempt to read fast even at the expense of accuracy, while others, the perfectionists, will trade any amount of speed to ensure accuracy (Torgesen & Hudson, 2006, p. 139).

Slow readers expend more effort than fast readers, and therefore have fewer cognitive reserves to arrive at the ultimate aim of comprehension (LaBerge & Samuels, 1974; Perfetti, 1985). Slow reading is primarily caused by inadequate word identification skills (Jenkins et al., 2003, p. 727). But regressive eye movements also slow down reading, especially when they are purposeless, as is often the case with a non-skilled reader.¹ Motivation comes into the picture too: a slow reader is less likely to choose to read, simply because it requires more time (Hale, Skinner, Wilhoit, Ciancio, & Morrow, 2012, pp. 540–541).

Instructional and assessment methods in WEIRD societies have often been geared towards merely increasing students' speed to the exclusion of accuracy, prosody and comprehension (Kuhn et al., 2010, p. 243; Rasinski et al., 2015, p. 146). Yet it is a conversational pace that should be the aim, not speed reading, because the latter has no intrinsic value without comprehension (Adlof et al., 2011, p. 198); it may just lead to the reader "gagging on print" (Levy et al., 1997, p. 187).

1. As Samuels et al. (2011, pp. 43–45) remind us, purposeful regressions – an intelligent comprehension check, for example – and forward saccades used to predict, exact a heavy price on reading speed even though they are entirely normal. In *Rapid Serial Visual Presentation* (RSVP), when the words of a text are presented successively in the same location thus eliminating eye movements, reading speed can reach 500 wpm, and even 800 wpm in short stints. But the cost to the reader is prohibitively high because it denies the possibility of confirmation and prediction. For a simple demonstration of RSVP, see <https://spritz.com> (accessed 29 March 2021).

A vast and varied literature on reading speed has emerged over the past fifty years including, to briefly illustrate the domain, investigations into the value of repeated reading techniques (Dahl 1979 cited in Levy et al., 1997, p. 174; Meyer & Felton, 1999); visually impaired readers' use of magnifiers (Ahn & Ledge, 1995); eye movements and visual span (Risse, 2014); legibility of text on font type, line spacing (Stone et al., 1999), font size (Schall et al., 2016); manipulation of presentation speed (Horowitz-Kraus, 2016, pp. 57–58; Nagler et al., 2016, pp. 108–110; Risse, 2014, pp. 1–2); dyslexia among Japanese children (Ogino et al., 2011); syllable training in Finnish (Heikkilä et al., 2013; Huemer et al., 2010); and text length in German (Altpeter et al., 2015).

Focusing the lens onto Africa, the prodigious increase in primary school enrolment since the turn of the 21st century has turned attention from quantity of enrolments to quality of instruction (Onsomu et al., 2005; Sampa, 2005; Sifuna, 2007), and this, in turn, has spawned a marked increase in experimental research on early grade literacy outcomes. A government-led study in Burkina Faso found that, among 512 grade 2 children, only 9% were able to read French (L2) fluently.² A subsequent experiment with 94 grade 3 pupils benefiting from repeated reading techniques and peer tutoring demonstrated reading speed gains, especially among struggling readers (Boily et al., 2015, pp. 245, 248). In Kenya, Piper & Zuilkowski (2015a, p. 164) find reading rates in Kiswahili (L2) to be systematically slower than in English (L3), but worryingly slow in both languages. They report no statistical difference in reading speed between oral and silent reading in either language. Nor do they find any bias for or against fast or slow readers in terms of fluency performance on time-delimited versus passage-delimited assessments in the same languages (Piper & Zuilkowski, 2015b, p. 93). In Lesotho, among grade 4 children reading English (L2), speed was improved by specific instruction, multiple teaching strategies and scaffolding (Van Staden, 2016, p. 27). All the above studies focus on children learning a second or third language, none of which are tonal.³

Adjusting the focus still more finely, we come to the literature on African tone orthography experimentation. The early experimenters report that multiple tone marks hinder reading speed in Efik (Essien, 1977, p. 159), Bura (Badejo, 1989, p. 48) and Yoruba (Klem, 1982, p. 24), and that they lengthen perception time in Efik (Essien, 1977, p. 159) and Kom (Bernard et al., 1995). Unfortunately, the results of

2. In fact, the authors do not mention which language was being tested, but one may assume it was French, the language of formal education in Burkina Faso.

3. Research on L1 literacy in Africa tends to conflate speed and accuracy into a single “words correct per minute” fluency measure. These studies will be evaluated in the following chapter (see pp. 224–226).

these investigations are questionable because of various design weaknesses. Three do not apply sound statistical methodology (Badejo, 1989; Essien, 1977; Klem, 1982) and the fourth is a single-subject experiment (Bernard et al., 1995). Essien (1977, pp. 164–166) presents juxtaposed artificially created tonally ambiguous sentences as stimuli, which is a highly unnatural literacy task. Intervention training time is also a concern. Essien (1977, p. 159) offered only 10 minutes in Efik and Bernard et al. (1995) only 15 minutes in Kom. Badejo (1989) does not even state whether his design includes a training phase.

Nevertheless, two more recent experiments, methodologically more robust, do concur with the earlier ones. Bernard et al. (2002, p. 345), in a re-run of his first Kom experiment, this time with 13 participants, finds that they perceive and oralize sentences written with tone marks more slowly than those without, although as sentence length increases – that is, as context widens – this effect is mitigated. Bird (1999, p. 98) reports that the presence of accents in Dschang adds an average of 7.5 seconds to the speed of reading 100 words ($p = 0.033$), in spite of the fact that the eleven participants were already used to full tone marking.

Roberts & Walter (2016, pp. 179–180), examining 14 tonally ambiguous monosyllabic verb roots in Kabiye, pitch a tonographic spelling against a morphographic spelling in a quantitative experiment. Pre- and post-test comparisons reveal much more modest reading speed gains in the Tonographic group (relative 11.9%; absolute 35.3%; $p = 0.173$) than in either the Morphographic group (relative 24.5%; absolute 76.4%; $p = 0.000$) or the Control group (relative 22.4%; absolute 64.9%; $p = 0.000$). The fact that the Tonographic group lagged behind the others suggests that they may have been slowed down by the extra burden of having to identify tone marks, though the between-group differences fall short of being statistically significant ($p = 0.194$).

With this background, we now turn to a presentation of the oral reading speed results, beginning with L2 performance (Section 2) and moving on to L1 performance, with the latter consisting of an overview (Section 3.1), a language-specific breakdown (Section 3.2), and a multilevel analysis of the impact of independent variables (Section 3.3). We conclude with our interpretation of the results (Section 4).

2. L2 oral reading speed

Mean L2 SPEED is 148.56 syllables per minute, which is roughly equivalent to what is expected of American children after two years of primary school.⁴ The box and whisker graph⁵ in Figure 1 shows L2 SPEED broken down by FOCAL LANGUAGE.

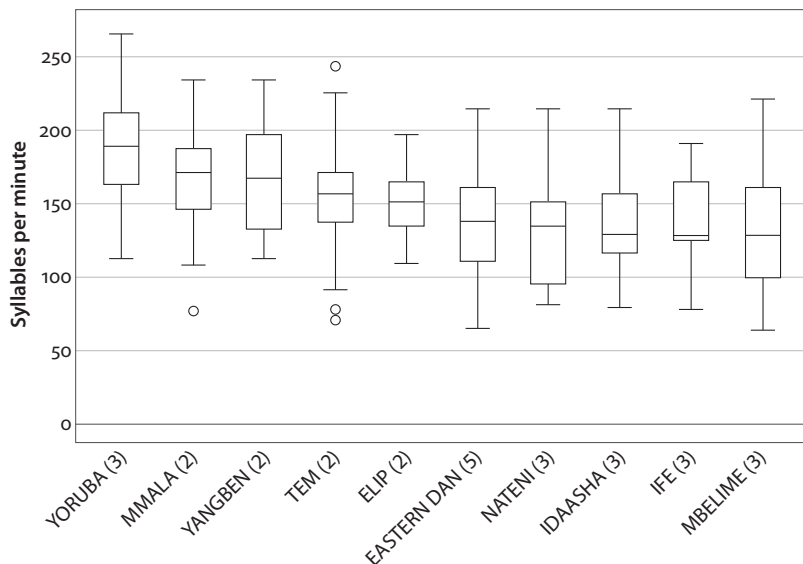


Figure 1. Mean L2 SPEED by FOCAL LANGUAGE

The YORUBA participants read faster than those of any other FOCAL LANGUAGE, with a mean L2 SPEED of 183.92 syllables per minute.⁶ Mean L2 SPEED is fairly homogenous in the five slowest languages. Table 1 summarizes the most parsimonious model accounting for the variation in the L2 SPEED data.

4. 148.56 syllables per minute = 104 wpm. The US National Assessment of Educational Progress recommends 100 wpm by the end of grade 2. <https://educationclearinghouse.files.wordpress.com/2011/10/fluency-standards-by-grade.pdf> (accessed 11 February 2021).

5. For readers unfamiliar with box and whisker plots, the lower edge of the box indicates the first quartile, the middle line the second quartile (the median), and the upper edge the third quartile of responses. The whiskers (that is, the lines extending above and below the box) indicate the upper and lower 25% of the sample, and the small circles indicate outliers. Here and in all similar graphs, the X-axis labels show the number of phonemic level tones in brackets after the name of the language.

6. We might equally state “L2 SPEED is faster in English than in French”, since YORUBA was the only group that was tested in English.

Table 1. Demographic variables impacting L2 SPEED

| | Coef | t | p | Impact (mean) |
|-----------------|-------|-------|-------|---------------|
| Constant | 87.56 | 13.31 | 0.000 | – |
| EDUCATION | 5.65 | 9.57 | 0.000 | 46.05 |
| GENDER (F) | 10.66 | 2.25 | 0.025 | 10.66 |
| EYESIGHT (poor) | 19.20 | 3.60 | 0.000 | 19.20 |

The model contains three demographic variables: EDUCATION, GENDER, and EYESIGHT. Of these, EDUCATION is by far the most salient predictor accounting for five times as much variance as the other two predictors combined. Participants gain 5.65 syllables in L2 SPEED for each additional year of EDUCATION ($t = 9.57$; $p = 0.000$). In addition, females showed an advantage over males of 10.7 syllables per minute, and participants with poor EYESIGHT read the L2 at a rate of almost 20 syllables per minute faster than those with good EYESIGHT.⁷

These L2 SPEED results set the scene for the analysis of L1 SPEED, which seeks to establish the extent to which the tone marking condition affected performance.

3. L1 oral reading speed

3.1 Overall results

Overall, although L1 SPEED is slightly faster on the FULL TONE texts (113.08 orthographic TBUs per minute) than on the ZERO TONE texts (109.36 orthographic TBUs per minute),⁸ this difference is not statistically significant ($p = 0.314$).⁹

7. Readers may be surprised that those with poor EYESIGHT read the L2 faster than those with good EYESIGHT. In fact, a closer examination of the data reveals that the modelled difference is based largely on a small number of high performing participants among those reporting poor EYESIGHT and who have no more than a primary level EDUCATION.

8. Or 58 wpm (ZERO TONE texts) and 60 wpm (FULL TONE texts), both of which are well below what the US National Assessment of Educational Progress recommends by the end of grade 1 primary school (75 wpm), (<https://educationclearinghouse.files.wordpress.com/2011/10/fluency-standards-by-grade.pdf>; accessed 11 February 2021), notwithstanding our concerns about employing the wpm measurement crosslinguistically (see p. 196).

9. Some evidence of group imbalance occurs at this point. GROUP 1 had a higher mean score on the marked texts (ZERO TONE 105.91; FULL TONE 115.75), while GROUP 2 had a higher mean score on the ZERO TONE texts (ZERO TONE 112.80; FULL TONE 110.16). Also, females outperform males in both conditions, with a distributional asymmetry in which females at the higher reaches of ability dramatically outperform their male counterparts by approximately 20%.

Plotting performance by individuals when reading ZERO TONE versus FULL TONE reveals an extremely high correlation and only 5% of data points lie outside of the confidence interval ($r = 0.92$; $t = 40.42$; $p = 0.000$; Figure 2).

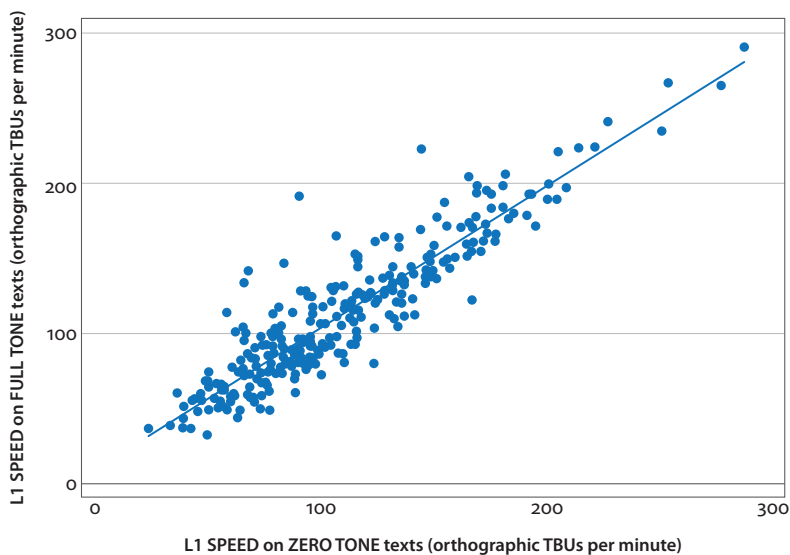


Figure 2. Correlation between L1 SPEED ON ZERO TONE and FULL TONE texts

By way of comparison, the correlation between L1 SPEED ON FULL TONE texts and L2 SPEED is not so strong ($r = 0.54$; $p = 0.000$). This overall pattern is an early indication that FULL TONE marking is not an important factor in predicting L1 SPEED, and that other variables may be responsible for most of the variance in the data. But before we investigate this possibility, it will be helpful to present the data language by language.

3.2 Language specific results

Figure 3 shows the mean L1 SPEED ON ZERO TONE and FULL TONE texts broken down by FOCAL LANGUAGE. None of the languages deliver persuasive evidence in favor of full tone marking, but in two the results come close to statistical significance (IFE 13.99% faster, $p = 0.060$; NATENI 12.37% faster, $p = 0.078$). The other eight languages show only a small difference in speed with four of these actually showing a decline when tone is fully marked. However, if three outliers¹⁰ are removed, the

10. These outliers had gains of greater than 50 orthographic TBUs per minute on the FULL TONE texts.

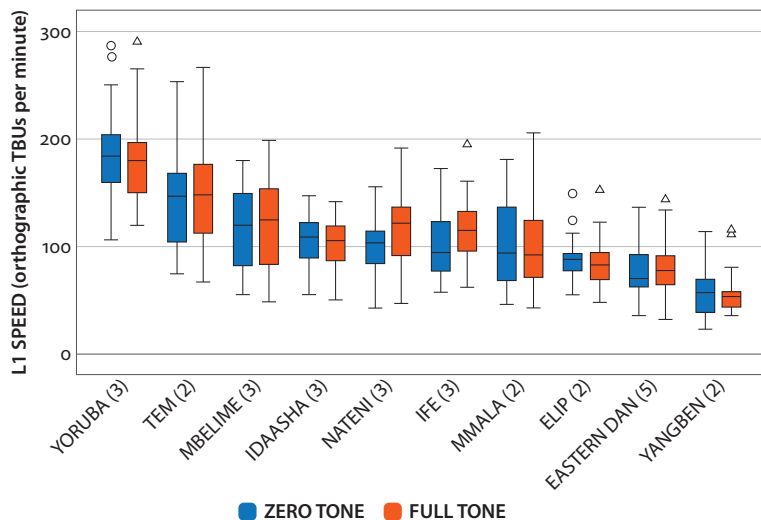


Figure 3. L1 SPEED on ZERO TONE and FULL TONE texts by FOCAL LANGUAGE

mean impact on L1 SPEED in NATENI and IFE is similar to that of the other eight languages and the overall impact of FULL TONE marking is reduced to less than one orthographic TBU per minute, again making it difficult to assign weight to the argument that FULL TONE marking has any systematic impact on L1 SPEED.

Participants in all languages read the L1 texts – irrespective of how tone was marked – slower than the L2 text, the difference being significant in three languages (ZERO TONE L1 SPEED as a percentage of L2 SPEED: ELIP 59.40%, $p = 0.000$; EASTERN DAN 57.56%, $p = 0.000$; YANGBEN 35.87%, $p = 0.000$). In contrast, whatever reading speed skills TEM and MBELIME participants have, they apply them more or less equally to their L2 and their L1. YORUBA is the only language where L1 SPEED on both ZERO TONE (185 orthographic TBUs per minute) and FULL TONE (183 orthographic TBUs per minute) texts outstrips the ten-language L2 SPEED average (149 syllables per minute), although neither score outperforms the YORUBA L2 SPEED average (223 syllables per minute).

We also examined the language specific results from the angle of group gains and losses, contrasting the percentages of participants who read the ZERO TONE and FULL TONE texts faster, as well as those for whom it made no, or scarcely any, difference¹¹ (Figure 4).

11. We considered anything within the range of plus or minus 2.5 orthographic TBUs per minute to indicate no change.

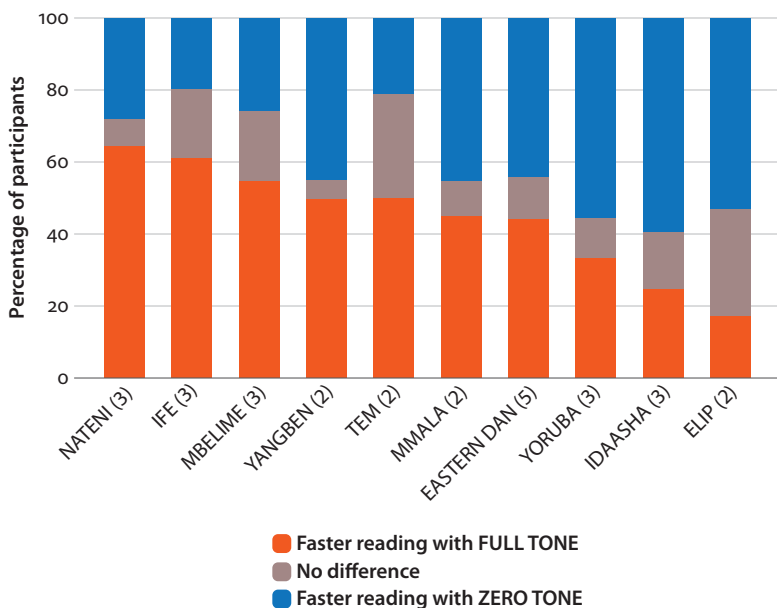


Figure 4. Group level gains and losses in L1 SPEED by FOCAL LANGUAGE

In only three languages did a majority of participants read the FULL TONE texts faster (NATENI 64%, IFE 61%, MBELIME 55%). In three languages a majority of readers read the ZERO TONE texts faster (IDAASHA 59%, YORUBA 56%, ELIP 53%). Every language had participants for whom reading speed was the same or almost the same whether or not tone was marked, and this pattern was particularly marked in ELIP (29%) and YANGBEN (29%).

3.3 Impact of independent variables

Our aim is to test the working hypothesis that FULL TONE marking improves L1 SPEED. In a traditional single level model, we might perform a paired t-test, and the result ($t = 3.44$; $p = 0.001$) would lend support to this working hypothesis. But does it continue to be supported once we take into consideration the many other factors that may impact the development of L1 reading skills? A null model reveals that almost half of the variation in performance among participants is accounted for by the language communities from which they come. This tells us that either the languages themselves or the various ethno-literacy contexts, or both, play a major role. Thus the next step in the analysis is to add additional variables to the null model to refine and improve it. Table 2 summarizes the multilevel model that

Table 2. Most parsimonious multilevel model explaining impact of independent variables on L1 SPEED when reading FULL TONE texts

| Level | Type | Variable | Coef | z | p |
|-------|----------------|-------------------------|-------|------|-------|
| 1 | Demographic | EDUCATION | 3.02 | 5.87 | 0.000 |
| 1 | Demographic | L1 EXPERIENCE | .94 | 4.36 | 0.000 |
| 2 | Ethno-literacy | L1 LANGUAGE DEVELOPMENT | 17.47 | 3.52 | 0.000 |

emerged as best explaining the variation in performance on L1 SPEED of FULL TONE texts.¹² This model provides a good fit for the data. It accounts for 12.53% of level 1 variance, 75.32% of level 2 variance, and 41.90% of overall variance in the data.

It will also be helpful to investigate the impact of each variable with respect to the coefficients (Table 3). We provide estimates of impact for three possible conditions: when the variable has its smallest possible (Min), the largest possible (Max), and the average (Mean) values found in the data.

Table 3. Estimated impact of independent variables at the minimum, mean and maximum levels of performance on L1 SPEED when reading FULL TONE texts

| | Coefficient | Values in the data | | | Estimated impacts | | |
|-------------------------|-------------|--------------------|-------|-----|-------------------|-------|--------|
| | | Min | Mean | Max | Min | Mean | Max |
| EDUCATION | 3.02 | 0 | 8.15 | 19 | 0 | 24.61 | 57.38 |
| L1 EXPERIENCE | .94 | 0 | 14.82 | 53 | 0 | 13.93 | 49.82 |
| L1 LANGUAGE DEVELOPMENT | 17.47 | 1 | 3.78 | 6 | 17.47 | 66.04 | 104.82 |

The level 1 variables – EDUCATION and L1 EXPERIENCE – indicate the actual and potential amount of variation in a participant’s L1 SPEED within their language community attributable to the indicated variable. Since the coefficients are derived from the complete data set, they are best interpreted as the average amount of impact one can expect within the language community, regardless of the community a participant is actually a member of. For example, each additional year of EDUCATION leads to an increase in L1 SPEED of 3.02 orthographic TBUs per minute. However, that gain is relative to the mean of a given language community. Since the mean number of years of EDUCATION was 8.15 years across the ten focal languages, a participant with this level of EDUCATION saw an increase in L1 SPEED of 24.61 orthographic TBUs per minute due to their formal schooling.

12. We also generated a ZERO TONE model but it produces almost identical results, which is unsurprising given the very high correlation between FULL TONE and ZERO TONE on the measure of L1 SPEED (p. 214).

The level 2 variable L1 LANGUAGE DEVELOPMENT is interpreted in a similar way but applies to language communities as units rather than to individual participants. For example, each unit increase in L1 LANGUAGE DEVELOPMENT increases the mean L1 SPEED of a given language community by 17.47 orthographic TBUs per minute. As a result, a language community that has an average level of L1 LANGUAGE DEVELOPMENT of 3.78 shows a mean increase in L1 SPEED of 66.04 for all members of that community.

Finally, Table 4 demonstrates that each additional variable improves the extent to which the model fits the data.

Table 4. Assessing model fit of L1 SPEED when reading FULL TONE texts with cumulative addition of independent variables

| | Log likelihood | AIC | BIC | Overall variance | |
|--------------------------|----------------|---------|---------|------------------|-------------|
| | | | | Explained | Unexplained |
| Null | -1532.68 | 3071.35 | 3082.52 | 0% | 100% |
| +EDUCATION | -1485.47 | 2978.93 | 2993.73 | 18.16% | 81.84% |
| +L1 EXPERIENCE | -1461.54 | 2926.71 | 2926.71 | 23.81% | 76.19% |
| +L1 LANGUAGE DEVELOPMENT | -1457.35 | 2926.71 | 2948.85 | 37.67% | 62.33% |

Most of the detail in Table 4 is technical and of interest only to those who make use of multilevel modelling, but a summary will be helpful for the inquisitive reader. Columns 2–4 characterize fit; in general, the smaller their value, the better the fit. Columns 5 and 6 report the amount of explained and unexplained variance respectively at the level of individual participants.

Adding L2 SPEED to the model significantly increases the fit with 52.2% of overall variance being accounted for. At the same time, EDUCATION drops out as being statistically insignificant. These two findings reinforce the view that L1 SPEED is much more a function of EDUCATION than it is of FULL TONE marking.

Finally, since EASTERN DAN has already been identified as a level 2 outlier for linguistic and social reasons (p. 201), and since this group lagged far behind the overall sample mean on the measure of L1 SPEED (Mean 78.97; 3.09 standard errors below the overall sample mean), we took the precaution of reanalyzing the data excluding EASTERN DAN. However, this did not greatly alter the multilevel model presented above, and we conclude that the L1 SPEED analysis was not significantly skewed by the presence of the EASTERN DAN data.

4. Interpretation and discussion

In this series of experiments, level of formal education is closely tethered to oral reading speed in the official language (L2). While this effect is to be expected, it is modest by standards in WEIRD societies where children are expected to show gains of 30–50 words per minute per year between grades 1 and 4 (Barr et al., 1995, p. 63). The gap between these two social contexts is surely due to the fact that in WEIRD societies, unlike most African societies, most children learn to read and write in their L1 and benefit from massive, daily exposure to its written form.

The Yoruba rank first on the measure of L2 oral reading speed. However, this series of experiments has not sought to tease out whether this is because of the many advantages in the Yoruba ethno-literacy environment, or because they were the only sample who read the L2 text in English rather than French.

Any interpretation of the L1 results must carry a warning. The fact that overall average reading speed is marginally faster when tone is fully marked must not be hastily interpreted as an indication of the success of full tone marking. Few of the participants have ever seen their language written with no tone marks, so the sheer strangeness of this experience is almost bound to cause them to proceed with greater caution, whether or not they ever actually make use of tone marks when they are present. What is perhaps more surprising is that absence of tone marks in the other condition did not derail participants more than it did: in most of the texts and in most of the languages any negative effect of not marking tone is negligible. This should act as a warning to any linguists who are still insisting on the importance of full tone marking out of a desire for phonological fidelity. The same comment should be borne in mind in Chapters 12–14 with relation to accuracy and comprehension.

The extremely strong correlation of L1 reading speed between the two experimental conditions indicates that the presence or absence of tone marking is not a reliable predictor of this measure. It also implies that a person's ability to read a tone marked text is strongly determined by general reading ability. Slow readers are going to read slowly and fast readers fast, irrespective of whether tone is marked. Furthermore, each language had a sizeable minority of readers for whom marking or not marking tone made no or precious little difference to reading speed, with Yangben being the most striking example.

Breaking the data down by focal language is especially germane to the research question, because if full tone marking makes a significant difference to oral reading speed, we would expect it to be evident across all the languages. However, this is not the case. The L1 reading speed results fail to make a convincing case in favor of full tone marking though they may, timidly, begin to help building a case for

it in Nateni and Ife. It does not go unnoticed that these two languages report the lowest mean level of education among participants and the highest level of L1 literacy activity. However, all in all, the data simply does not exhibit the level of cross-linguistic uniformity that one would expect if full tone marking really had a systematic and beneficial impact on reading speed in these ten languages. Any remaining proponents of full tone marking for all African tone languages would do well to take note.

It will also be helpful to compare the L2 and L1 results. In the African context, the opportunity to acquire L1 literacy skills does not usually come until one has finished school or reached adulthood. Therefore it is reasonable to expect that predictive models of reading speed will differ between the language of formal education and the participant's own language, and indeed our results confirm this. The vast majority of participants had a faster reading speed in their L2 than in their L1 irrespective of whether tone was marked in the latter. L2 performance is an extremely strong predictor of L1 performance on this measure, dominating all other contributors (cf. Piper & Miksic, 2011, pp. 171–174), again irrespective of whether tone is marked. Reading skills transfer quite readily from one language to another under the right conditions. Furthermore, when a participant has a large differential between L2 and L1 reading speed, they generally have weak L1 reading skills. Parity between L1 and L2 reading speeds generally requires a reading speed in both languages of between 140 and 160 orthographic TBUs or syllables per minute. Nevertheless, a sizeable number of participants did read the L1 faster than the L2, and in Yoruba, the average L1 reading speed was faster than the ten-language L2 average. This is unsurprising, given that it is the only focal language whose written form is taught in school.

All these findings suggest that there is considerable potential for reading speed to be or become faster in the L1 than in the L2 and that, as L2 reading skills grow, they can be readily applied to the L1, bequeathing a strong advantage to participants with knowledge of the official language. Fast L2 readers – generally those who have been to school for longer – readily apply their skills to reading texts with no tone marks, apparently unfazed by their absence. Conversely, fast L2 readers are less negatively affected by the presence of tone marks than slow L2 readers, but we do not know the reason for this: they may either be making more use of the diacritics or be ignoring them altogether. We also need to add a note of caution because these overall remarks hide language specific differences. The Yangben participants have some of the fastest French reading speeds and some of the lowest L1 reading speeds. In this language, at least, L2 skills have clearly not yet transferred successfully to the L1, and the presence or absence of tone marks does nothing to help or hinder whatever transfer does exist.

Level 2 linguistic variables are conspicuous by their absence throughout the multilevel analysis of L1 reading speed. All the variables with the greatest predictive power have to do with the literacy profile of either the individual participant or the language community. In particular, the level of vision, leadership, and resources for ongoing L1 language development is a very plausible predictor of L1 reading speed and such attributes more than compensate for any minor deficiencies in a language's orthography. This perspective is consistent with two widely cited European studies (Seymour, 2005; Seymour et al., 2003) which provide evidence that languages with deeper orthographies take longer to master, but once mastered in a favorable educational environment, become readable with levels of proficiency similar to those of shallower orthographies.

Tone orthography and general oral reading accuracy (*David Roberts, Stephen L. Walter*)

1. Introduction

Accuracy is the ability to recognize known words and decode unknown words correctly. Along with speed and prosody, it is one of the major components of oral reading fluency and a key contributor to comprehension (Abbott et al., 2012; Adlof et al., 2011, pp. 197–198; Fuchs et al., 2001, p. 243).

It is common to find strong correlations between oral reading speed and accuracy (Abu-Leil et al., 2014, pp. 264–265; Barr et al., 1995, p. 63), but these can be susceptible to subtle variations in how and in what context they are measured. Gove & Wetterberg (2011, pp. 11–17), for example, argue that accuracy rates can vary quite dramatically based on such issues as whether one is reading word lists or connected text, the transparency of the orthography (Seymour et al., 2003) and the level of morphosyntactic structure in a given language.

As we already noted for reading speed (see p. 209), if a reader's attention is absorbed in letter, syllable and word decoding, no cognitive resources will be left for the higher skill of comprehension (LaBerge & Samuels, 1974; Perfetti, 1985). But accuracy is apparently more important than speed in this respect: research shows that children who read accurately but slowly usually have good comprehension so long as their oral language comprehension skills are also good (Adlof et al., 2011, pp. 197–198).

Accuracy involves the sub-skills of understanding the alphabetic principle, acquiring vocabulary, gaining automaticity in word recognition, blending sounds together and using context cues for identification (Rasinski & Samuels, 2011, p. 95; Torgesen & Hudson, 2006, p. 133). To read accurately, learners need texts that are pitched at an appropriate level of difficulty, and this is particularly important at early levels. For intermediate and advanced learners, in contrast, a challenging text may be motivational (Allington et al., 2015, p. 171).

Walczyk & Griffith-Ross (2007, pp. 561–562) list numerous ways in which weak readers compensate for sources of confusion: they may slow down; they may pause; they may glance at or repeat the immediately preceding text; they may sound out a word; they may analogize with a known spelling; they may guess from context;

they may skip a word they consider to be unimportant; and – an option that was not available to the participants in our series of experiments – they may access an exterior resource such as a dictionary.

Formal assessments of oral reading accuracy tend to be grouped into two types. On the one hand, standardized reading achievement tests aim to rank students' performance by comparison with a norm. On the other hand, informal reading inventories assess performance with reference to fixed criteria, each corresponding to a different level such as 'independent level', 'instructional level' and 'frustration level' (Meazzini, 1985, p. 35).

The literature on reading accuracy in English is vast, and includes investigations from a wide range of angles such as morphological awareness (Deacon et al., 2013), self-correction (Clay, 1968, 1969; Weber, 1970a, 1970b), text difficulty (Blaxall & Willows, 1984), variation in teacher instructions (Taylor et al., 2013) and word length (Martens & de Jong, 2006). Studies on other languages investigate accuracy with relation to word length in Albanian (Avdyli & Cuetos, 2012), visual similarity of letters in Italian (Cossu et al., 1995), method of instruction in Brazilian Portuguese (Cardoso-Martins, 2001), dyslexia in Japanese (Ogino et al., 2011), error instability in Dutch (Steenbeek-Plantinga et al., 2013), sub-lexical units in Danish (Veber Nielson, 2016) and context dependent consonants in Spanish (Goikoetxea, 2006; Jiménez & Hernández, 2000; Valle-Arroyo, 1989), Italian (Job et al., 1998) and French (Peerean, 1995).

Once the focus turns to Africa, a worrying picture emerges. Currently, some of the most significant research is emerging from South Africa. Draper & Spaul (2015, p. 71) report crippling poor English (L2) fluency rates – fewer than 40 wcpm – for 41% of grade 5 children in rural schools. In an experiment with South African university students reading isiZulu (L1) and English (L2), Land (2011, p. 64) reports that “the scores of nearly all the readers are consistent with very low levels of reading skills, yet all the readers had the benefit of tertiary education ... it is possible that the reading difficulties faced by second language academics are underestimated.” Among 44 grade 4 isiZulu readers, only half the words could be read correctly, with a mean score of 19 wcpm (Pretorius 2015, cited in Spaul et al., 2020, p. 7), and similar results were found among 55 grade 3 readers of isiXhosa (Diemer 2015, cited in Spaul et al., 2020, p. 7). Ninety-seven Grade 3 Northern Sotho readers averaged only 35 wcpm (Maukare 2017, cited in Spaul et al., 2020, p. 7, and see Wilsenach 2013, 2015). Spaul et al. (2020, p. 7) mention similar findings in Setswana (Malda et al., 2014) and Herero (Vei & Everatt, 2005). In their own study of Northern Sotho, Xitsonga and isiZulu, Spaul et al. (2020, pp. 7, 11–13) identify a need to establish accuracy thresholds, individualized by language, below which it is virtually impossible to read for meaning.

The South African findings are echoed elsewhere on the continent. In Senegal, Mejía & Pouezevara (2011, p. 54) class 18% of grade 3 children as “non-readers” on the grounds that they were unable to read correctly a single word of the first sentence of a text in French (L2 or L3); average fluency of the remaining children was very low at 22 wcpm. In Mali, between 50% (in Bamanankan) and 70% (in Bomu, Fulfulde and Songhoy) of end-of-grade-1 children were unable to identify a single letter sound from their alphabets. Furthermore, between 50% (in Bamanankan) and 60% (in Bomu, Fulfulde and Songhoy) of end-of-grade-3 children were unable to read a single word on a list of frequently used words in their language (Ralaingita & Wetterberg, 2011, p. 97).¹ In Kenya, Piper & Miksic (2011, pp. 168–169) report high percentages of grade 3 learners with zero scores (i.e. no words read correctly) on an oral reading fluency task (Dholuo L1 20%; Gikuyu L1 14.5%; Swahili L2 18.6%; English L3 14.0%) and even higher percentages in Uganda (Lango L1 50.9%; Luganda L1 25.8%; English L2 44.8%).

With so many wide-ranging reports of poor reading skills it is small wonder that so much research is currently paying attention to different ways of enhancing quality of instruction. Many of these initiatives do indeed improve L2 reading accuracy, whether it concerns repeated reading techniques and peer tutoring in Burkina Faso (Boily et al., 2015); care and education of pre-schoolers in Zambia (McCoy et al., 2017); multiple strategies and scaffolding in Lesotho (Van Staden, 2016); semi-scripted lessons, teacher training and text message support in Kenya (Jukes et al., 2017); improved teaching techniques, materials, community involvement, and report-based accountability in Liberia (Davidson et al., 2011); instructional materials, teacher guides, improved teacher training, and ongoing classroom support in Kenya (Piper et al., 2015); use of the L1 for basic reading instruction in Zambia (Tambulukani & Bus, 2012); or scripted L1 lessons in South Africa (Setswana, Sepedi, and isiZulu) and Mali (Bamanankan, Bomu, Fulfulde and Songhoy) (Ralaingita & Wetterberg, 2011).

Several of the languages mentioned in the preceding paragraphs are not tonal, and most of those that are do not mark tone in their orthographies;² in any case tone was not the focus of the authors. An entirely separate branch of research, far more modest, evaluates the effectiveness of African tone orthographies, and in this repertoire all the experiments that include an oral reading task measure accuracy.

1. The reference to “Bamanankan-language schools” implies that these were monolingual schools. However, the authors point out that the notion of a school necessarily having a single language of instruction is an over-simplification (Ralaingita & Wetterberg, 2011, p. 92).

2. Bomu marks lexical and grammatical tone (Carin Boone p. c.). We have been unable to obtain any information for Lango.

An experiment in Efik (Essien, 1977, pp. 159–161) asks whether or not the pronunciation of the entire sentence was correct. The results report 28.8% accuracy when tone is partially marked and 26.6% accuracy when it is fully marked. The author also notes that it is impossible to measure accuracy on the unmarked (standard) orthography, precisely because the sentences have not been disambiguated by the addition of diacritics. A single-subject Kom experiment (Bernard et al., 1995, pp. 31, 36–38) and a ensuing replication with 13 participants Bernard et al. (2002, pp. 342–344) both follow Essien's scoring procedure. They conclude that the longer the sentence, the more likely it is to be read accurately, irrespective of whether tone marks are present, because the reader benefits from context. They also report that proverbs are read more accurately than other types of sentence and that the more time a participant takes to perceive and vocalize the sentence, the less likely it is that it will be read accurately.

Klem (1982, p. 24) counts the average number of oral reading errors in a 100 word Yoruba text and finds 3.8 errors in the zero tone version; 1.6 errors in the partially marked version, and 2.3 errors in the full tone version. Duitsman (1986) uses the same measurement in Western Krahn, reporting, across four grades, an average of 22 errors in the accentual (standard) orthography and 27 when tone is marked with punctuation symbols. Badejo (1989, p. 47) reports 60% accuracy of targeted lexemes in the Bura standard orthography, which does not mark tone, and 100% accuracy in an alternative that marks it fully. Mfonyam (1989) reports the average accuracy rates for oral reading of four experimental orthographies in Bafut (Stable 89.8%; Basic 61.5%; Minimal 59.5%; Surface 57.1%, p. 309–348) and Limbum (Stable 80.89%; Unstable 62.55%; Minimal 73.65%; Surface 50.80%, p. 459–473). Bird (1999, p. 98) reports that the presence of accents adds an average of 2.7 hesitations or repetitions to the reading of two Dschang texts, although the results fall just short of being statistically significant ($p = 0.0537$).

So far researchers have not achieved consensus. On the one hand, Klem (1982, p. 24) and Badejo (1989, p. 48) claim that full tone marking contributes to accuracy in reading of Yoruba and Bura, respectively. On the other hand, Bernard et al. (2002, p. 355) and Bird (1999, p. 98) contend that it does not contribute, and may even contribute negatively, to accuracy in Kom and Dschang, respectively. Greater weight must be accorded to the latter pair of experiments because they employ robust statistical methodology.

The following sections continue to investigate performance of the oral reading task described on p. 193, this time reporting on errors of all types – consonants, vowels and tone, hereafter referred to as “general oral reading errors” – in the zero tone and full tone versions of the four L1 texts. After investigating the L2 results (Section 2), the L1 results are presented in the form of an overview (Section 3.1), a

language-specific breakdown (Section 3.2), and a multilevel analysis of the impact of independent variables (Section 3.3). We conclude with our interpretation of the data (Section 4). The aim of this chapter is to paint a broad canvas of reading accuracy before proceeding, in Chapter 13, to an investigation of tonal errors alone.

2. L2 oral reading accuracy

Most participants read the L2 texts with relatively few errors, but breaking the scores down by FOCAL LANGUAGE (Figure 1)³ reveals a wide spread, with MBELIME readers performing with the highest error rate (median 5.58 errors per 100 syllables) and ELIP the lowest (median 1.52). Five languages perform above the overall group average (5.36) and five below. L2 ERRORS tends to be inversely proportional to L1 SPEED (see p. 215), but the former vary more than the latter, with the highest individual rate of L2 ERRORS being more than three times that of the lowest.

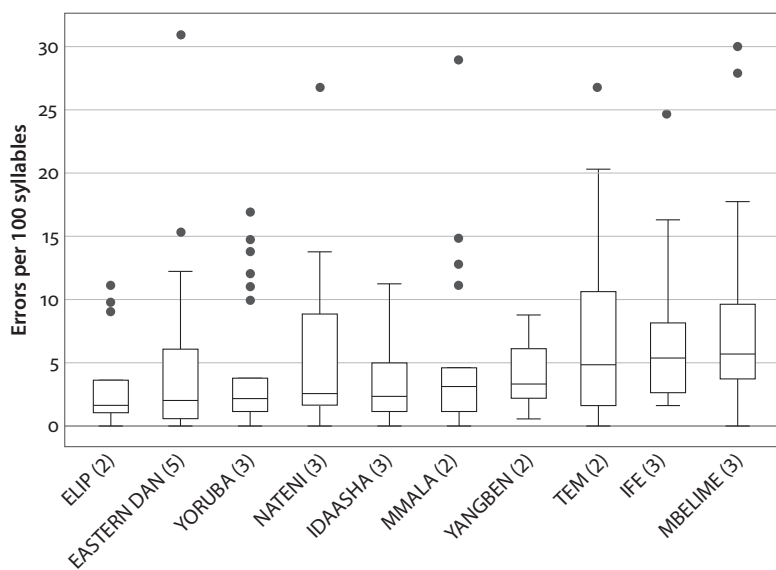


Figure 1. L2 ERRORS by FOCAL LANGUAGE

3. For an explanation of how to interpret box and whisker plots, see p. 212, footnote 5.

Table 1 reports the results of a multiple regression analysis investigating the impact of demographic variables on L2 ERRORS.

Table 1. Variables impacting L2 ERRORS

| | Coefficient | t | p | Impact (mean) |
|----------|-------------|-------|-------|---------------|
| Constant | 23.338 | 12.00 | 0.000 | 23.338 |
| AGE | -.113 | 3.78 | 0.000 | -4.618 |
| L2 SPEED | -.090 | 10.06 | 0.000 | -13.370 |

Both independent variables have negative coefficients, indicating that they contribute to a reduction in L2 ERROR rates, with L2 SPEED having the strongest impact (though it overlaps with EDUCATION).⁴ Specifically, those who read the L2 slower than 100 syllables per minute averaged 16.3 errors per 100 words, while those who read at 100 syllables per minute or faster averaged 3.9 errors per 100 words ($F = 123.81$; $p = 0.000$). The handful of readers who made the most L2 ERRORS all represent those associated with the slowest L2 SPEED rates of 70–100 syllables per minute. L2 SPEED and L2 ERRORS have a moderately strong negative correlation ($r = -0.53$; $F(1, 226) = 87.98$; $p = 0.000$). The regression also retains AGE, signaling that each additional year decreases the number of L2 ERRORS by just over 0.11. The overall model is robust, accounting for a large amount of variance in the data ($R^2 = 33.11\%$).

3. L1 oral reading accuracy

3.1 Overall results

The correlation between L1 SPEED and L1 GENERAL ERRORS falls in the range of -0.52 to -0.61 , which is very similar to the correlation between L2 SPEED and L2 ERRORS. The correlation in L1 GENERAL ERRORS between ZERO TONE and FULL TONE texts is very strong ($r = 0.81$, $F(1, 265) = 495.18$; $p = 0.000$; Figure 2).

This pattern strongly suggests, as with the L1 SPEED results (see p. 213), that the underlying basis for explaining the variation in the data has little or nothing to do with the presence or absence of FULL TONE marking, and that other variables may be largely responsible for the variance in the data. We will explore this possibility in due course, but first it will be helpful to investigate the results language by language.

4. A separate ANOVA investigating the relationship between L2 ERRORS and EDUCATION is statistically significant ($r = -0.21$, $f = 9.83$ $p = 0.002$).

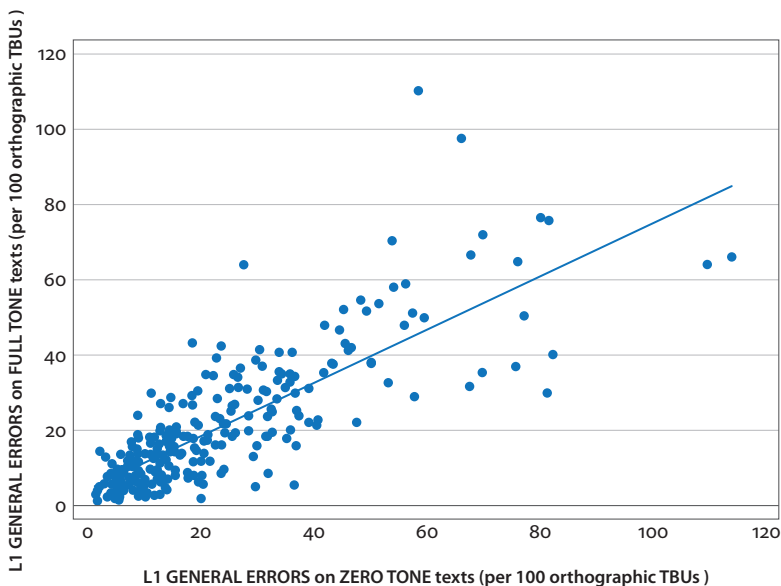


Figure 2. Correlation between L1 GENERAL ERRORS ON ZERO TONE and FULL TONE texts

The error rate when reading the L1, irrespective of whether tone is fully marked is dramatically higher than when reading the L2 (ZERO TONE L1 GENERAL ERRORS 22.90; FULL TONE L1 GENERAL ERRORS 20.66; L2 ERRORS 5.36), and this difference is much greater than the equivalent comparison for L1 SPEED (see p. 214).

Comparing the two L1 conditions, we find that FULL TONE marking resulted in a mean reduction in L1 GENERAL ERRORS of 2.23 (9.7%), but this difference falls marginally short of being statistically significant using a t-test for the difference of means ($p = 0.072$).

3.2 Language specific results

When the L1 GENERAL ERRORS data is broken down by language a more nuanced picture emerges (Figure 3).

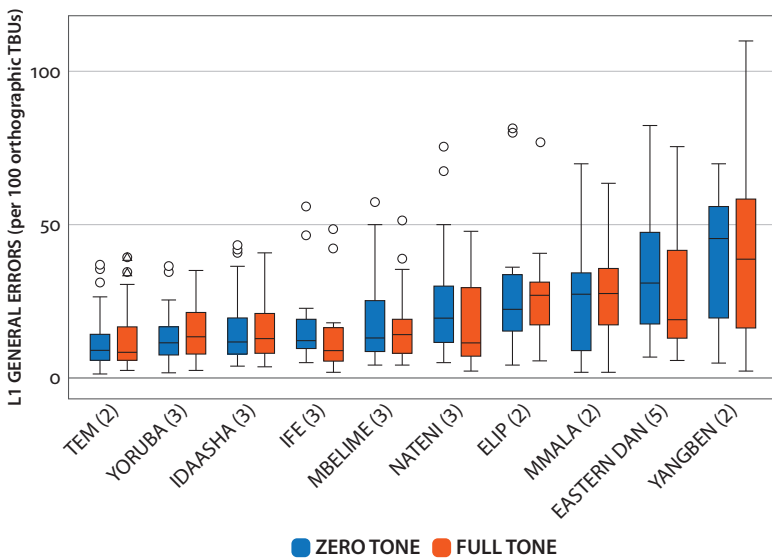


Figure 3. L1 GENERAL ERRORS ON ZERO TONE and FULL TONE texts by FOCAL LANGUAGE

The results reveal a wide disparity, with YANGBEN readers scoring over three times as many L1 GENERAL ERRORS as TEM readers. These extremes correspond quite closely, although inversely, to the patterns revealed in the L1 SPEED analysis (see p. 215). The results for the FULL TONE and ZERO TONE texts are broadly similar, but two languages come close to statistically significant reductions in L1 GENERAL ERRORS when tone is marked: NATENI (26.09%, $p = 0.073$), and EASTERN DAN (18.95%, $p = 0.094$).

Another angle on the language specific results is to compare group level gains and losses on L1 GENERAL ERRORS. Figure 4 shows, for each FOCAL LANGUAGE, the percentage of participants who scored more L1 GENERAL ERRORS on the ZERO TONE texts and on FULL TONE texts. Overall, 42% of participants scored more L1 GENERAL ERRORS on the ZERO TONE texts, 30% scored more L1 GENERAL ERRORS on the FULL TONE text, while a similar proportion (28%) scored more or less evenly irrespective of whether tone was marked.⁵ In three languages, the majority of participants did indeed score more L1 GENERAL ERRORS on the ZERO TONE texts (IFE 69%, EASTERN DAN 66%, NATENI 60%). In no language did more participants score more L1 GENERAL ERRORS on the FULL TONE texts, while in YORUBA the largest group is composed of those for whom the presence or absence of tone marking made no, or very little difference (56%).

5. We considered anything within a range of plus or minus 2.5 errors per 100 orthographic TBUs of difference to indicate no change.

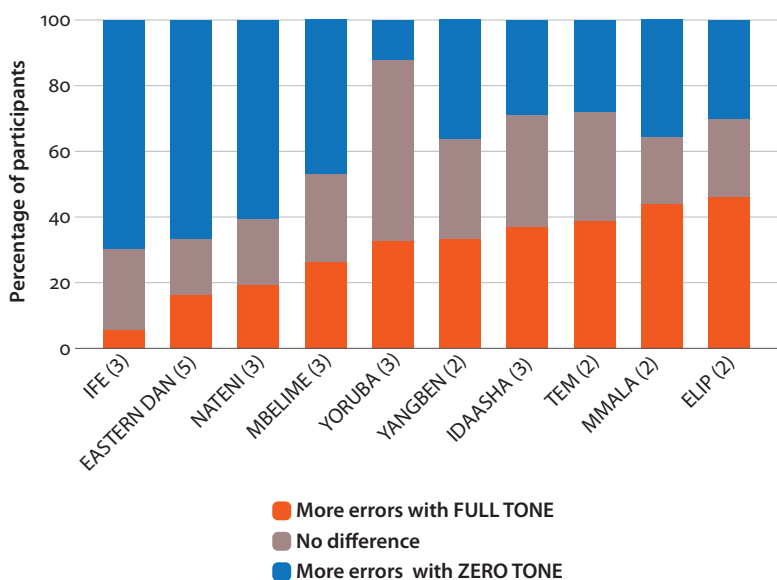


Figure 4. Group level gains and losses in L1 GENERAL ERRORS by FOCAL LANGUAGE

3.3 Impact of independent variables

A paired sample t-test appears to lend support to the working hypothesis that FULL TONE marking reduces L1 GENERAL ERRORS ($t = 3.28$; $p = 0.001$). On this basis, if we were dealing with a truly random sample of participants all coming from a homogeneous population, we might claim that FULL TONE marking does indeed reduce the number of L1 GENERAL ERRORS. However, by now we are aware of very large asymmetries in the population so we need to control for other possible effects before making any judgment. For that purpose, we turn to a multilevel model that allows us to take into account a range of factors to do with the profiles of both the individual participant and the language communities to which they belong.

Table 2 summarizes a parsimonious multilevel model of the impact of independent variables on L1 GENERAL ERRORS when reading FULL TONE texts.⁶

6. We also generated a ZERO TONE model but it produces almost identical results, which is unsurprising given the very high correlation between FULL TONE and ZERO TONE on the measure of L1 GENERAL ERRORS (see p. 229).

Table 2. Most parsimonious multilevel model explaining impact of independent variables on L1 GENERAL ERRORS when reading FULL TONE texts

| Level | Type | Variable | Coefficient | z | p |
|-------|----------------|-------------------------|-------------|------|-------|
| 1 | Demographic | L1 EXPERIENCE | -0.37 | 3.81 | 0.000 |
| 2 | Ethno-literacy | L1 LANGUAGE DEVELOPMENT | -4.43 | 2.83 | 0.005 |
| 1 | Demographic | L1 READING FREQUENCY | -.01 | 1.70 | 0.088 |

The model contains only three terms – two level 1 variables and one level 2 variable. Two of these (L1 EXPERIENCE, L1 LANGUAGE DEVELOPMENT) already appeared in the reading speed analysis (p. 217). The negative values of all three coefficients indicate that the higher the value of the independent variable, the lower the L1 GENERAL ERROR rate (and therefore the greater the accuracy).

The relatively low level of variance accounted for (level 1 = 7.08%; level 2 = 61.4%; overall = 19.7%) is offset by the parsimony of the model. When other independent variables were added to increase the amount of variance accounted for, this produced anomalous coefficients or generated models that lacked adequate theoretical justification.

Table 3 examines the data in terms of the estimated impact of the three variables on L1 GENERAL ERRORS based on their coefficients.

Table 3. Estimated impact of independent variables based at the minimum, mean and maximum levels of performance on L1 GENERAL ERRORS when reading FULL TONE texts

| | Coefficient | Values in the data | | | Estimated impacts | | |
|-------------------------|-------------|--------------------|--------|-----|-------------------|--------|--------|
| | | Min | Mean | Max | Min | Mean | Max |
| L1 EXPERIENCE | -.374 | 0 | 14.82 | 53 | 0 | -5.54 | -19.82 |
| L1 LANGUAGE DEVELOPMENT | -4.432 | 1 | 3.78 | 6 | -4.43 | -16.75 | -26.59 |
| L1 READING FREQUENCY | -.006 | 0 | 338.63 | 730 | 0 | -2.03 | -4.38 |

The figures in columns 6–8 indicate the estimated impact when the individual or language community manifests a minimum, mean or maximum value, respectively. For example, in the first row, L1 EXPERIENCE reports a mean value of 14.82. This value multiplied by the coefficient of $-.374$ indicates that an average participant would see a reduction of 5.54 L1 GENERAL ERRORS if they reported having an average amount of L1 EXPERIENCE. L1 LANGUAGE DEVELOPMENT, in the second row, is interpreted in the same way but, being a level 2 variable, its impact applies to the entire language community. Thus, an average language community saw its mean rate of L1 GENERAL ERRORS reduced by 16.75 when the L1 LANGUAGE DEVELOPMENT variable had a value of 3.78. According to the model, the maximum potential impact of this variable is 26.59 L1 GENERAL ERRORS. The highest actual gap between language communities in the data was 30 L1 GENERAL ERRORS.

Table 4 provides some detail on model fit. Readers without a background in multilevel modeling may want to bypass it and the accompanying explanation. The main point is to demonstrate that each additional variable added to the model improves some aspect of model fit. This is reflected by a range of indicators which show improved fit by either increasing or decreasing values.

Table 4. Assessing model fit of L1 GENERAL ERRORS when reading FULL TONE texts with cumulative addition of independent variables

| | Log Likelihood | AIC | BIC | Overall variance | |
|---------------------------|----------------|---------|---------|------------------|-------------|
| | | | | Explained | Unexplained |
| Null | -1220.32 | 2446.64 | 2457.67 | 0 | 100% |
| + L1 EXPERIENCE | -1188.38 | 2384.76 | 2399.40 | 6.23% | 93.77% |
| + L1 LANGUAGE DEVELOPMENT | -1185.51 | 2381.02 | 2399.32 | 13.61% | 86.39% |
| + L1 READING FREQUENCY | -1176.61 | 2365.21 | 2387.13 | 15.60% | 84.40% |

The null model can be thought of as an empty model containing the level 1 units (individual participants) and the level 2 units (language communities) but no independent variables. It does not account for any variance, but does give an indication of how the raw variance is split between the units of levels 1 and 2.⁷ Columns 5 and 6 show the amount of overall variance explained by the independent variables cumulatively added to the model. Overall, the model accounts for approximately 15.6% of raw variance. But one more important point needs to be added: If L2 SPEED is added to the cumulative model its presence triples the amount of level 1 variance accounted for from 17% to 51%, dramatically improving model fit even though it has nothing to do with tone and has only an indirect link to L1 SPEED.

Finally, we turn to the issue of whether the presence of EASTERN DAN, which has been identified as a level 2 outlier for linguistic, orthographic and social reasons (p. 201), might be distorting the analysis. In fact, although their mean score on L1 GENERAL ERRORS (27.89) is well above that of the entire research population, it is not dramatically out of the mainstream as the three Bantu languages (ELIP, MMALA and YANGBEN) performed at a similar or worse level. Nonetheless, excluding the EASTERN DAN group from the dataset modestly improves the model fit, and interestingly, one of the variables – L1 READING FREQUENCY – become non-significant statistically. When this variable is removed, the model is slightly weaker overall but much stronger if EASTERN DAN is excluded.

7. In the case of L1 GENERAL ERRORS, the proportion of total model variance allocable to level 2 units is 21.1%.

4. Interpretation and discussion

As noted in Section 1, the wider literature often reports reasonably strong correlations between oral reading speed and accuracy, and this proved to be true in the current data set as well. Most participants read the L2 text quite accurately and those who did not were also the slowest readers. However, the different focal languages show considerable variation. The anticipated trend is most noticeable when the Mbelime participants read French: they have the slowest speed and the lowest accuracy. Among the Yoruba, on the other hand, their considerably faster English reading speed is not necessarily matched by greater accuracy.

Ample evidence exists showing that lack of fluency in deep orthographies like English and French is usually characterized by oral reading that is not only slow but also error-strewn. Dysfluencies among learners of shallow orthographies such as Italian or Finnish, on the other hand, tend to consist of slow and laborious but relatively accurate reading (Avdyli & Cuetos, 2012, pp. 137–138; Heikkilä et al., 2013, p. 399). The results of our series of experiments do not tally with the wider literature. The ten orthographies are all relatively shallow when tone is fully marked, yet oral reading in all of them is both slower and more inaccurate than it is in the relatively deep L2 orthographies that the same subjects were also tested in, this trend being particularly noticeable in Yangben. While the L2 reading skills developed in formal education were identified as having an impact on L1 reading speed (see p. 217), the same kind of transfer is not evident in the case of accuracy. In all cases, it is surely the ethno-literacy context – with its strong emphasis on the L2 in school and the relative lack of exposure to the written form of the L1 – that accounts for this disparity.

The analysis of L1 general reading error rates might appear to make a slightly stronger case in favor of marking tone fully than does the analysis of reading speed (see p. 213), the penalties for zero marking being a 9.7% loss of general accuracy but only a 3.3% loss of speed. But in fact, the former shrinks to just 3% once we take the latent variable that we might term “generic reading skill” into consideration (recall that the addition of L2 oral reading speed to the L1 multilevel model dramatically improves its fit), so both measures have broadly equivalent outcomes. The emerging picture is that full tone marking is quite incidental to any observed differences in general error rates between the two conditions and plays no critical role in the readability of L1 texts in these ten languages.

Overall, general oral reading error rates on the tone marked texts are lower than those where the tone was stripped out, but when the two are plotted against each other, the correlation is very strong. The scatter is much narrower at the lower end of the trend line, suggesting that good readers are minimally affected by whether

or not tone is fully marked while struggling readers are much more likely to rely on them, or at least to be more perturbed by their unexpected absence. Taking each language on a case-by-case basis, full tone marking may, cautiously, provide limited evidence of an advantage for Eastern Dan and Nateni. However, the effect in neither language is dramatic, and in the majority of languages, the tally of gains and losses was equal or almost equal whether or not the texts were fully tone marked.

As for the multilevel model, it should not surprise us to see level 1 literacy variables and level 2 ethno-literacy variables appearing together. The former are dependent on the latter since it would be impossible for an individual to acquire L1 literacy skills without a community-level decision to develop an orthography, publish literature and organize a literacy program.

The multilevel model, like the parallel model for the reading speed chapter (see p. 216), identifies no linguistic variables as being predictive of performance. Rather, it is an ethno-literacy variable that measures vision, leadership and resources for ongoing L1 language development that has by far the biggest impact, and that impact is exerted at the level of language communities rather than that of individual participants. This effect is buttressed by those demographic variables that have to do with L1 literacy, such as experience and reading frequency, that are more reliable predictors of general reading accuracy, although we have remaining questions about Eastern Dan in this regard.

Error rates, then, are apparently more a function of the literacy profile of the individual and the language community than they are of the linguistic and orthographic profile of the language. This finding points to a pressing need for orthography developers to assess the representation of tone from a literacy angle in addition to the almost purely linguistic considerations that have so often absorbed the attention of researchers.

Tone orthography and tonal oral reading accuracy

(David Roberts, Stephen L. Walter)

1. Introduction

Prosody, along with speed and accuracy, is generally considered to be one of the major components of reading fluency (Dowhower, 1991; Kuhn et al., 2010, pp. 233–239; Schreiber, 1991). The term refers, in non-tonal languages, to suprasegmental information such as intonation, stress, phrase boundaries and expression (Torgesen & Hudson, 2006, p. 134), but in tone languages its use is often extended to include the tonal tier (e.g. Anderson & Wang, 2012; Chirkova & Michaud, 2009; Ouyang & Kaiser, 2015; Rialland, 2007).

Assessments often overlook prosody completely (Dowhower, 1991, p. 165), in spite of the fact that children rely heavily on prosodic features to understand speech (Allington, 1983, p. 557; citing Schreiber, 1980). The *Early Grade Reading Assessment* (EGRA) is the most widely used instrument in the developing world, having been used in 65 countries and adapted into more than 100 languages, yet has been criticized for giving insufficient attention to prosody (Piper & Zuilkowski, 2015b, pp. 78–79). Certainly, measuring prosody in non-tonal languages can be a slippery process, notwithstanding the development of some imaginative and helpful instruments (e.g. Dowhower, 1987, p. 394; Hudson et al., 2005, p. 707; Pinnell et al., 1995). In tone languages, on the other hand, an L1 scorer – given adequate training and supervision – can indeed systematically measure prosody, as it relates to tone, because each orthographic TBU, by definition, requires a specific tone. In that sense, tracking prosody in a tone language can be viewed as merely an extension of measuring accuracy, rather than – as it is usually presented in the literature on non-tonal languages – an entirely separate component of reading fluency. Another difference is that prosody in a non-tonal language tends to be only partially coded orthographically, by punctuation and word boundaries (Hudson et al., 2005, pp. 704–705), whereas in some tone languages, including all the focal languages in our series of experiments, tone is fully marked. Finally, while some doubt that appropriate prosody is an aid to comprehension in a non-tonal language (Torgesen & Hudson, 2006, p. 135), in a tone language, especially one with a heavy functional load of tone, its contribution to comprehension is likely to be much more important.

2. Literature overview

2.1 Asian languages

The last two decades have seen a surge in experimental research on the role of tone in reading Asian writing systems. In contrast to the African literature on the same subject, these experiments tend to be designed and implemented by psychologists interested in the cognitive processes involved in the reading process. The authors are not necessarily involved in orthography development or reform, though some do extend their discussions to the pedagogical implications of their findings. Another major difference between the Asian and African literature is that the extant Asian experiments tend to focus on individual word and character recognition rather than passage reading.

2.1.1 *Chinese characters*

Much of the focus of recent research in the Asian literature has been on visual word processing of Chinese traditional characters (e.g. Chen et al., 2003; Lee, 2007) and transfer of tone processing among Mandarin-English bilinguals (Wang et al., 2008; Wang et al., 2005; Wang et al., 2009), Cantonese-English bilinguals (McBride-Chang et al., 2008; Tong et al., 2017; Tong et al., 2015) and mono- and bi-dialectal Mandarin speakers (Wiener & Ito, 2015). One might legitimately ask how insightful a focus on tone can be in a logographic writing system that does not explicitly mark tone, but as McBride-Chang et al. (2008, p. 175) point out, each Chinese character indirectly maps to a particular pronunciation which includes its tone, and therefore it implicitly and simultaneously conveys both segmental and tonal information. Chinese characters often succeed in separating tonal minimal pairs in writing, albeit by an indirect, meaning-based route which Roberts & Walter (2012) have advocated for representing grammatical tone in certain African languages.

Still, the visual word processing of a logographic writing system and the emphasis on bilingualism are of only tangential interest to the present study. More obviously relevant are the numerous recent experiments conducted on Pinyin – the romanization developed on mainland China for teaching Chinese to L1 children and L2 learners – given that this writing system represents tone transparently and exhaustively by means of diacritics.¹ Apart from any other consideration, it is worthy of attention because it is by far the world's most widely used tone orthography.

1. Two tone marking systems exist for Pinyin (Wang et al., 2015, p. 5). For a summary of tonographic correspondences, see Wang & Gao (2011, p. 143) and Xu et al. (2014, pp. 75–76) for the diacritic system and Shu et al. (2008, p. 173) for the numbering system. Since the advent of computers and Unicode, the diacritic system tends to be favored.

2.1.2 *Pinyin*

Shu et al. (2008) find that grade 1 formal instruction in Pinyin results in dramatic improvement in tone awareness. Siok & Fletcher (2001) find that knowledge of Pinyin and the ability to discriminate homophonic characters predicts reading success after grade 1. Wang & Gao (2011, pp. 147–148) report that, in a word analogy task, L1 Mandarin kindergartners were able to make more accurate pronunciation analogies reading words in Pinyin when the target syllable had the same tone as the clue syllable. In a short-term recall task, the same children recalled written syllables more accurately when tone was matched across the items in a list than when it was unmatched.

Huff & Payne (2012) examine the interpretation of monosyllabic homophones and tonal minimal pairs written in Pinyin stripped of tone marks with 22 L1 Mandarin speakers. Their task was to select on a screen one of two Chinese characters that corresponded to a Pinyin stimulus. The results indicate a strong role for high lexical frequency, and little evidence of tone affecting the pattern of responses. Li et al. (2014) investigate production and perception of Mandarin tones by 16 Cantonese learners, comparing oral reading errors when stimuli were written in Pinyin and in Chinese characters. Their results show that Pinyin facilitated correct tone production although participants were not necessarily aware of the meanings.

Wang et al. (2015), in two naming tasks using Chinese characters and Pinyin as primes presented at three different durations, find that with logographic Chinese characters, segmental and tonal information are represented and encoded as an integral unit, but with phonographic Pinyin, tonal information is accessed at a later stage than segmental information. Xu et al. (2014) explore tone perception among adult L1 Cantonese speakers learning Mandarin as L2. Participants listened to a Mandarin word and were asked to choose the corresponding written word in Pinyin or Chinese characters. Listeners perceived tone with greater accuracy in Pinyin, but only in monosyllabic, not disyllabic words.

2.1.3 *Thai*

The Thai orthography has also received considerable recent attention and it is directly relevant to the present study because, like the focal languages in our series of experiments, it represents tone fully and phonographically. Thai is interesting, not only because it uses a non-Roman script but also because the representation of tone is inconsistent and relatively deep.² This is presumably why, in spite of rapid development of literacy skills between grades 1 and 2, tonal oral reading errors persist among older children (Winskel & Iemwanthong, 2010, p. 1044).

2. For a summary of Thai tonographic correspondences see Winskel (2011, pp. 743–744) and Winskel et al. (2017, pp. 1283–1284).

In an eye movement experiment of Thai silent reading, Winskel (2011) finds that incorrect tone marking presented in parafoveal preview (i.e. 6–8 letters to the right of the eye's fixation) substantially retards the subsequent processing of the target word, suggesting that readers do pay attention to tone marks and that they play an important role in early word recognition.

Masked priming, a computerized technique used to ascertain whether exposure to a partially obscured stimulus influences response to an ensuing target,³ has been used to investigate processing of segments and tones in Thai. Davis et al. (2016) find that, for word naming, the development of tonal information is slower than for vowel information. Winskel & Perea (2014) report parallel results for lexical decision and word naming tasks suggesting that consonantal information is more important than tonal information in the early stages of visual word processing, and that access to phonological tone information occurs relatively late.

Winskel et al. (2017) employ a Stroop task – i.e. naming the color in which a word is printed while ignoring the meaning of the word itself⁴ – in combination with manipulated tone marks and initial consonants. They find that tone information comes into play at a relatively late stage in lexical processing and that orthographic information contributes more to word recognition than phonological information.

Burnham et al. (2011) demonstrate that both lexical tone awareness and phonological awareness were predicted by reading ability in Thai children learning the Thai orthography, where tones are represented orthographically, whereas no such association is found for Cantonese children learning Chinese traditional characters in which tone is not directly represented.

2.2 African languages

A curious aspect of the early African tone orthography experiments is that, in spite of their supposed focus on tone, they do not actually measure tonal errors separately from other kinds of errors. As we saw in the previous chapter (p. 225), this is the case with Efik (Essien, 1977, pp. 160–161), Western Krahn (Duitsman, 1986, pp. 6–7), Bafut (Mfonyam, 1989, p. 334), Limbum (Mfonyam, 1989, p. 466), and Kom (Bernard et al., 1995, p. 31; 2002, p. 342). Two other experiments, in Yoruba (Klem, 1982) and Bura (Badejo, 1989), do not clearly specify how errors

3. For a simple demonstration of masked priming in English see: www.u.arizona.edu/~kforster/priming/masked_priming_demo.htm (accessed 26 January 2021).

4. For a simple demonstration of a Stroop task in English, see https://www.psychtoolkit.org/lessons/experiment_stroop.html (accessed 26 January 2021).

were counted. That leaves only two experiments that clearly measure tone accuracy separately from general accuracy.

Firstly, Bird (1999, p. 97) counts tonal errors in Dschang by having an L1 speaker review the recordings and judging whether each tone error resulted in a different interpretation of the word or of the grammatical construction. Rather confusingly, these were classified as comprehension errors, while remaining tone errors were classified as performance errors. Nevertheless, Bird does make a clear division between general and tonal errors and is much more explicit than any other previous researcher about how errors were counted. The results also distinguish between lexical errors (Zero Tone 0; Full Tone 3) and grammatical errors (Zero Tone 18; Full Tone 11).

Secondly, Roberts & Walter (2016, pp. 180–181), examine 14 tonally ambiguous monosyllabic verb roots in Kabiye, pitting a tonographic spelling against a morphographic spelling in a quantitative experiment. Accuracy was scored as “... the number of accurate readings of lexical tone on the focal verbs, i.e. only the focal verb root was scored, not the entire sentence, nor even the entire verb phrase; and only tones were scored, not segments.” The morphographic group shows the largest gains in tone reading accuracy between the pre-test and the post-test (absolute gains 37.2%; relative gains 100.7%; $p. = 0.000$), while the tonographic group gains merely shadow those of the control group.

All this provides the necessary background to return to our own series of experiments and continue our investigation of performance during the oral reading task described on p. 193. The following sections set forth an analysis of tonal oral reading errors, which are a sub-set of the general oral reading errors reported in Chapter 12. If, as is often claimed, full tone marking is critical to successful oral reading of a tone language, we would expect that readers would make many tonal errors when reading zero tone texts; however, the following analysis reveals that this is not the case. Section 3 reports the results, consisting of an overview (Section 3.1), a language-specific breakdown (Section 3.2), and a multilevel analysis of the impact of independent variables (Section 3.3). We conclude with our interpretation of the results (Section 4).

3. Tonal oral reading accuracy

3.1 Overall results

The overall rate of L1 TONAL ERRORS on the ZERO TONE texts is higher than that of the corresponding FULL TONE texts by an overall average of 1.39 errors per 100 orthographic TBUs ($t = 2.51, p = 0.013$). Although this is a significant effect, it is largely due to the number of errors in both conditions being quite low.⁵ In fact, nearly half of all participants made fewer than five L1 TONAL ERRORS per 100 orthographic TBUs however tone is marked. At the same time, a scattering had much higher scores (20+), which elevated the group means, serving as a reminder that mean scores often obscure important effects and may even present a distorted picture.

A scatter plot comparing L1 TONAL ERRORS on ZERO TONE and FULL TONE texts (Figure 1) confirms a strong correlation between the two.

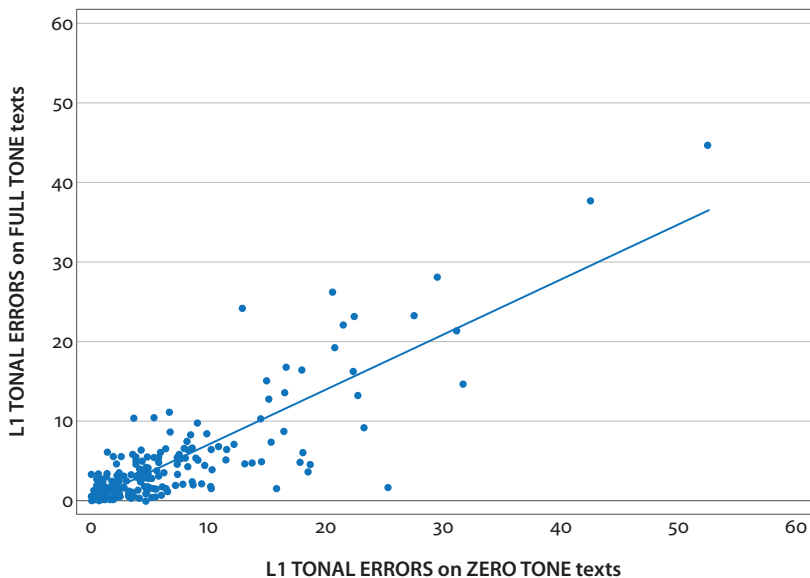


Figure 1. Correlation between L1 TONAL ERRORS ON ZERO TONE and FULL TONE texts (per 100 orthographic TBUs)

5. There is also a notable GENDER effect. Females read tones more accurately, and this difference is significant on ZERO TONE texts ($p = 0.025$) but not on FULL TONE texts ($p = 0.350$). Female participants were generally better readers than males throughout the research project.

The dense cluster of data points in the left lower corner of the graph indicates the low levels of L1 TONAL ERRORS in both conditions. Even though the graph reveals considerable scatter when the number of L1 TONAL ERRORS exceeds ten, the correlation between the two conditions is strong ($r = 0.85$; $p = 0.000$). This provides strong initial evidence that rates of L1 TONAL ERRORS have little to do with whether or not tone is marked. In general, whether a reader made many or few L1 TONAL ERRORS on the ZERO TONE texts they made a similar number of errors on the FULL TONE texts. These results closely shadow the parallel comparisons on the measures of L1 SPEED (p. 214) and L1 GENERAL ERRORS (p. 229).

Weak readers who attempt to read fast tend to make more errors. Therefore, it is not surprising to find that the correlation between L1 SPEED and L1 TONAL ERRORS is negative ($r = -0.35$, $t = 6.43$, $p = 0.000$). Furthermore, since L1 TONAL ERRORS are a sub-category of L1 GENERAL ERRORS, it is predictable that the correlation between them would be positive ($r = 0.55$, $t = 11.16$, $p = 0.000$).

3.2 Language specific results

Figure 2 presents L1 TONAL ERRORS broken down by FOCAL LANGUAGE.⁶

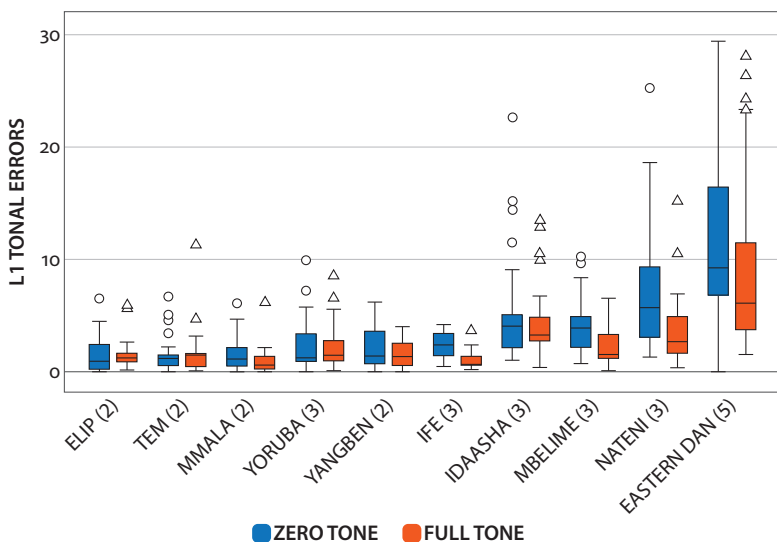


Figure 2. L1 TONAL ERRORS on ZERO TONE and FULL TONE texts by FOCAL LANGUAGE (per 100 orthographic TBUs)

6. See p. 212, footnote 5 for an explanation of how to read box and whisker graphs.

Several things are striking about Figure 2. Firstly, irrespective of whether or not tone is marked, the average number of L1 TONAL ERRORS in EASTERN DAN is far higher than any other FOCAL LANGUAGE. In fact, EASTERN DAN participants made up only 17.8% of the total sample but are responsible for 44.4% of all tonal reading errors; we will return to this point further on. Secondly, FULL TONE marking significantly reduces L1 TONAL ERRORS in only two languages (IFE -58.14% , $p = 0.001$; NATENI -51.15% , $p = 0.001$), although another one comes close to being significant (MBELIME -43.46% , $p = 0.090$). Thirdly, six languages (ELIP, TEM, MMALA, YORUBA, YANGBEN, IFE) have strikingly low rates of L1 TONAL ERRORS irrespective of whether tone is marked. Variation due to language (one-way ANOVA) accounts for a sizeable amount of variation in the data (ZERO TONE $F = 17.24$, $p = 0.000$, $R^2 = 35.21\%$; FULL TONE $F = 16.82$, $p = 0.000$, $R^2 = 32.78\%$).

We also investigated L1 TONAL ERRORS in terms of group level gains and losses. Figure 3 shows, for each language, the percentage of participants who scored more L1 TONAL ERRORS on the ZERO TONE and FULL TONE texts, as well as those for whom it made no difference.⁷

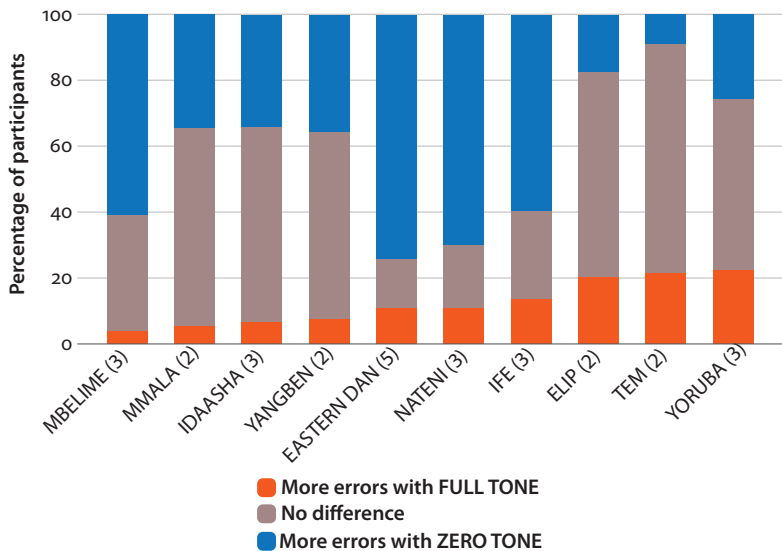


Figure 3. Group level gains and losses in L1 TONAL ERRORS by FOCAL LANGUAGE

7. We considered anything within the range plus or minus 2.5 L1 TONAL ERRORS per 100 orthographic TBUs of difference to indicate no change.

In four languages, the majority of participants scored more L1 TONAL ERRORS on the ZERO TONE texts (EASTERN DAN 74%, NATENI 70%, MBELIME 62%, IFE 60%). In six languages, the majority was made up of those for whom marking or not marking tone made no, or very little difference (TEM 70%, ELIP 65%, MMALA 60%, IDAASHA 59%, YANGBEN 57%, YORUBA 52%). TEM is the only language in which more participants score more L1 TONAL ERRORS on the FULL TONE texts than on the ZERO TONE texts.

3.3 Impact of independent variables

A paired-sample t-test suggests a large effect for FULL TONE marking on the number of L1 TONAL ERRORS ($t = 6.87, p = 0.000$). Even though the absolute difference is actually quite small (ZERO TONE 5.45; FULL TONE 3.90), it is statistically significant because of relatively large sample sizes and small standard errors. However, Figure 2 already drew attention to the large variation in the data by language, the most extreme example being that the mean number of L1 TONAL ERRORS for EASTERN DAN is more than 11 times that of IFE. Such patterns drew us to the use of multilevel models as a better statistical mechanism for explaining observed variation in the data. Table 1 reports the most parsimonious model.⁸

Table 1. Most parsimonious multilevel model explaining impact of independent variables on L1 TONAL ERRORS when reading FULL TONE texts

| Level | Type | Variable | Coefficient | <i>z</i> | <i>p</i> |
|-------|-------------|-----------------|-------------|----------|----------|
| 2 | Linguistic | NUMBER OF TONES | 3.13 | 6.49 | 0.000 |
| 1 | Demographic | AGE | -0.06 | 2.36 | 0.018 |

The model accounts for very little level 1 variance (15.09%) but most level 2 variance (86.15%). However, in terms of overall variance, it only accounts for 32.66% because 75.29% of the model variance occurs at level 1 and only 24.71% at level 2. The presence of NUMBER OF TONES in this model is noteworthy not only because it is the most salient ($Z = 6.49$), but because it is the first time that a level 2 linguistic variable has appeared in the statistical analysis (cf. Speed p. 216; General Errors p. 231). The coefficient suggests that each additional phonemic level tone in a FOCAL LANGUAGE increases the number of L1 TONAL ERRORS by 3.13 per 100 orthographic TBUs. This element of the model seems inconsistent with the fact

8. We also generated a ZERO TONE model but it produces almost identical results, which is unsurprising given the very high correlation between FULL TONE and ZERO TONE on the measure of L1 TONAL ERRORS (see p. 242).

that the mean tonal error rate is 1.43 errors for 2-tone languages and 2.98 for three tone languages. This issue is investigated on the following pages. The data set also contains eight outliers representing participants with exceptionally high rates of L1 TONAL ERRORS (three or more standard deviations above the sample mean). Analysis excluding these outliers merely reduced the size of the coefficients; the overall fit barely changed.

Table 2 provides some detail on the potential impact of the multilevel model predicting performance of participants on the measure of L1 TONAL ERRORS when reading FULL TONE texts.

Table 2. Estimated impact of independent variables based at the minimum, mean and maximum levels of performance on L1 TONAL ERRORS when reading FULL TONE texts

| | Coefficient | Values in the data | | | Estimated impact | | |
|-----------------|-------------|--------------------|-------|-----|------------------|-------|-------|
| | | Min | Mean | Max | Min | Mean | Max |
| NUMBER OF TONES | 3.127 | 2 | 3 | 5 | 6.25 | 9.38 | 15.64 |
| AGE | -0.060 | 13 | 40.87 | 71 | -7.8 | -2.45 | -4.26 |

The numbers in columns 3–5 show the actual minimum, mean and maximum values of the two retained variables in the data, while the corresponding numbers in columns 6–8 show the respective impacts predicted by the model. Of the two variables retained in the model, NUMBER OF TONES has the greater potential impact. It is a level 2 variable so its impact occurs at the level of the language community but extends to all participants within that community. Thus, a language with the mean NUMBER OF TONES (3) is predicted to have a mean increase of 9.38 L1 TONAL ERRORS. As for the AGE range, it is from 13 to 71 with the mean age being 40.87. The negative coefficient indicates that the oldest participant is predicted to make slightly fewer L1 TONAL ERRORS than the youngest. Table 3 provides detail on how well the model fits the data.

Table 3. Assessing model fit of L1 TONAL ERRORS when reading FULL TONE texts with cumulative addition of independent variables

| | Log Likelihood | AIC | BIC | Overall variance | |
|-------------------|----------------|---------|---------|------------------|-------------|
| | | | | Explained | Unexplained |
| Null | -899.31 | 1804.66 | 1815.66 | 0% | 100.00% |
| + NUMBER OF TONES | -890.63 | 1789.26 | 1803.98 | 31.03% | 68.97% |
| +AGE | -847.72 | 1705.44 | 1723.72 | 60.13% | 39.87% |

The starting point is the null model, which reflects the structure of a multilevel model but contains no independent variables, then each successive line adds another variable. The numbers in columns 2, 3 and 4 are all technical indices of fit in which, in general, decreasing size with the addition of each variable shows improved fit. The percentages in columns 5 and 6 show the amount of variation in individual performance explained and unexplained by the cumulative addition of variables respectively. The full model explains 74.42% of the individual variation in L1 TONAL ERRORS.

Finally, the analysis needs to separately address the possibility of EASTERN DAN having a distorting effect because this language has been identified as a level 2 outlier for linguistic, orthographic and social reasons (p. 201), and because it has by far the highest mean number of L1 TONAL ERRORS irrespective of whether tone is marked. Table 4 compares the results of the multilevel model for L1 TONAL ERRORS with and without EASTERN DAN in the dataset.

Table 4. L1 TONAL ERRORS when reading FULL TONE texts with and without EASTERN DAN

| | Sample mean | Raw variance | % variance explained | Improvement in model fit |
|----------------------|-------------|--------------|----------------------|--------------------------|
| All data | 4.06 | 37.37 | 39.9% | – |
| EASTERN DAN excluded | 2.40 | 6.78 | 9.04% | –77.34% |

This comparison points in two directions. First, EASTERN DAN accounts for 81.86% of all the variance in the complete dataset, and this heavily influences the content of the multilevel model. When the EASTERN DAN data are removed, NUMBER OF TONES becomes statistically nonsignificant ($z = 1.79$, $p = .074$). Both the over-predictions of error rates in Table 2 and the modeled consequences of removing the EASTERN DAN data suggest that the model expressed in Table 2 is primarily a function of this one outlier language.

Second, the L1 TONAL ERRORS results are remarkably consistent across L1 language community (the level 2 units). The variable AGE, which is the only remaining variable in the multilevel model once EASTERN DAN and NUMBER OF TONES are removed, accounts for less than 10% of the small amount of residual variance. In fact, the correlation between AGE and L1 TONAL ERRORS is close to zero.

The fact that the error rates were so low and there was so little variance present in the data implies that marking full tone has very little to do with the rates of tonal accuracy in oral reading.

4. Interpretation and discussion

If marking tone fully were critical to accuracy, readers would be expected to experience significant difficulty when reading zero tone texts. However, even though virtually no participants had ever previously encountered L1 texts with no tone marks, very few exhibited significant difficulty in reading them. At first sight, the overall data does cautiously provide some evidence that full tone marking may reduce tonal reading errors. However, any advantage is slight and is also tempered by the fact that all the participants are used to seeing full tone texts, so the sudden absence of tone diacritics may have been inhibiting. As yet it remains unclear whether we are dealing with learned behavior or scriptal necessity.

In any case, tonal errors represent only a small proportion of the general errors reported in Chapter 12. We should not conclude from this that readers are necessarily struggling more with segments than they are with tone. The difference is more likely to be due to the fact that repetition is by far the most common kind of general oral reading error – often spanning an entire phrase or sentence – and this error type was included in the general error count but not in the tonal error count.

Any claim that the presence of full tone marking does slightly reduce L1 oral reading tone errors hides language specific differences. In fact, it makes a statistically significant contribution only in Nateni, Ife and possibly Mbelime. As for the gains and losses analysis, it reveals that full tone marking is beneficial for a majority of participants in Eastern Dan, Nateni and Mbelime. The fact that in only one focal language, Tem, did a majority of participants score more tonal errors on the tone marked texts could, perhaps, be seen as evidence that even if marking tone fully does not bring significant benefits, at least it does not have a strong negative impact on most readers. This finding, coupled with the fact that in six languages (Yangben, Idaasha, Yoruba, Mmala, Elip, Tem), the largest group was made up of those for whom tone marks made no real difference, is another indication that many readers are ignoring them altogether.

The exceptionally high rate of tonal errors in Eastern Dan is particularly worrying. Either marking tone with punctuation is less effective than its proponents claim, or tone pedagogy needs improving, or this language community is an aberrant case for cultural, historical, or educational reasons. Certainly, L1 reading skills in Eastern Dan are weak across the board compared to the other focal languages. Neither can we rule out the procedural possibility that the capacity of L1 test administrators to identify tonal errors may be greater in a language with a heavier functional load of tone. Admittedly, the gains and losses analysis provides limited proof that marking tone fully may help to reduce tonal errors in Eastern Dan, which, in turn, may provide some support in favor of the punctuation strategy. It

was this finding that led us to investigate the orthography of this language more closely in a second experiment (Roberts, Basnight-Brown, & Vydrin, 2019).

The multilevel investigation of the impact of independent variables introduces almost as many questions as it answers. The apparent increase in tonal errors accompanying an increase in the number of phonemic level tones is noteworthy for being the first time that a linguistic variable has emerged in the statistical analysis, but it is exclusively due to Eastern Dan with its five tones and weak overall reading skills.

At first sight, the appearance of the age variable in the multilevel model may suggest an experiential or practice effect, and this assertion has support from the finding that the L1 experience variable can replace the age variable with minimal impact on either the coefficients or the amount of variance accounted for. However, this is rather surprising because age is not necessarily a proxy for experience. An older participant may have known how to read for decades but actually read rarely, whereas an enthusiastic young neo-literate may read frequently. In this series of experiments, it is those in the youngest language group (Yoruba) who have the longest experience reading their own language.

Tone orthography and oral reading comprehension

(*David Roberts, Stephen L. Walter*)

1. Introduction

Oral reading comprehension is “the process of simultaneously extracting and constructing meaning through interaction with written language” (Snow 2002 cited in Schimmel & Ness, 2017, p. 390). It is the primary outcome of reading fluency and the ultimate aim of reading, and this secures it a privileged position among our findings. In contrast to speed and accuracy, comprehension depends on knowing the language of a text. While this does not guarantee comprehension, not knowing the language of a text guarantees a lack of comprehension. The pointlessness of reading without understanding is captured in the oft-quoted expression “barking at print” (Kirwan, 1983). Yet it is not a spontaneous process: poor readers need deliberate instruction to direct their attention to comprehension (Duke et al., 2011, pp. 63–73; Moats, 2004, pp. 279–281; Pressley et al., 2006, pp. 62–63), a consideration that is often sidelined both as a classroom activity (Kamil, 2004, p. 221; Williams, 2015) and in assessment (Adlof et al., 2011, pp. 202–206).

Over the past forty years, the topic of comprehension has received a great deal of attention among researchers. Arguably the most important finding is the strong link between fluency and comprehension (Barr et al., 1995; Pinnell et al., 1995; Rasinski, 2006, pp. 14–15; Rasinski et al., 2015, pp. 143–145; Stahl, 2004, pp. 188–189) though some consider the impact to be bidirectional (e.g. Stecker et al. 1998 cited in Pikulski & Chard, 2005; Klauda & Guthrie 2008 cited in Price et al., 2016, p. 195). Abadzi (2012) argues that the link between fluency and comprehension is more a feature of human cognition than of the nature of the reading task. Specifically, she suggests that a reading speed of approximately 40 wpm is necessary to free up the cognitive resources needed to give attention to comprehension. Spaul et al. (2020, p. 12) make similar claims for Northern Sotho (52–66 wcpm), Xitsonga (39–48 wcpm) and isiZulu (20–32 wcpm).

Other studies compare comprehension between oral versus silent reading (e.g. Price et al., 2016; Schimmel & Ness, 2017; Walczyk & Griffith-Ross, 2007), and between oral language skills and reading (e.g. Adlof et al., 2011). Yet others investigate comprehension with relation to vocabulary acquisition (e.g. Kamil, 2004; Price

et al., 2016; Verhoeven & Van Leeuwe, 2008), context (e.g. Jenkins et al., 2003; Levy et al., 1997), ongoing motivation (e.g. Guthrie & Humenick, 2004, pp. 343–345), repeated reading procedures (e.g. Dowhower, 1987; Pikulski & Chard, 2005, pp. 513, 516), prosody (e.g. Veenendaal et al., 2015), domain and world knowledge (e.g. Duke et al., 2011, pp. 56–57), gaze durations (e.g. Just & Carpenter, 1980), and reading under time pressure (e.g. López-Escribano, 2016; Walczyk & Griffith-Ross, 2007, p. 564).

Yet in spite of such a vast literature, as recently as 2002 the executive summary of the RAND Reading Study Group's report controversially claimed, "... although basic reading processes are well understood, the current state of knowledge in reading comprehension was not sufficient. Existing research, although sizeable, was termed sketchy, unfocused, and inadequate as a basis for reform in reading comprehension instruction" (McCardle & Chhabra, 2004, p. 472). If some authorities consider this to be the case in WEIRD societies, how much more must it be true in Africa, where research assessing comprehension as an early level literacy outcome has only recently begun to emerge?

In their literature review, Spaul et al. (2018, pp. 8–9) cite two isiXhosa studies that report correlations between oral reading fluency and comprehension. In the first, it is found to be strong (Diemer, 2015); in the second, less so (Rees, 2016). The latter claim is supported by findings in Setswana (Malda et al., 2014) and Herero (Veii & Everatt, 2005). In contrast, the results of their own study of Northern Sotho, Xitsonga and isiZulu show that, although comprehension is generally low, it does correlate strongly with oral reading fluency (p. 11).

Draper & Spaul (2015, p. 45) refer to a "crisis of reading" in South Africa because the vast majority of children cannot read for meaning by the end of grade 4, whether in their L1 or their L2, and almost a third are still functionally illiterate in English (L2) by the end of grade 6. Their experiment reports silent reading comprehension scores averaging only 20.5%. Malda et al. (2014, p. 43), in a study comparing orthographic depth in English, Afrikaans and Setswana find that a reading comprehension task was very difficult for the Setswana (L1) group, in spite of its shallow orthography. Mean comprehension among 55 grade 3 learners of isiXhosa was 23% (Diemer 2015, cited in Spaul et al., 2020, p. 7).

The crisis is by no means limited to South Africa. Onsomu et al. (2005), cited in (Dubeck et al., 2012, p. 51), find that only 21% of 6th grade Kenyan students reach a comprehension level sufficient to succeed in the next grade, while 66% reach a level that would permit them to barely survive in the next grade. Mejía & Pouezevara (2011, p. 54) report very low comprehension results among grade 3 Senegalese children learning written French (L2 or L3), with only five out of 687 children being able to answer at least five of the six questions correctly. One cannot

help but wonder why policy makers continue to ignore the African elephant in the room: in by far the majority of cases, children are not learning in their L1.

Unsurprisingly, then, randomized control trials exploring quality of instruction are the order of the day. Van Staden (2016, p. 27) finds that specific instruction, multiple teaching strategies and scaffolding improves English (L2) oral reading comprehension of grade 4 children in Lesotho. Davidson et al. (2011, p. 118) report that, among grade 2 and 3 children in 180 Liberian schools, the treatment group, which benefited from improved teaching, provision of materials, community involvement and report-based accountability, made significant English (L2)¹ comprehension gains in comparison to control schools. Ralaingita & Wetterberg (2011, p. 94) undertook experiments in South Africa (Setswana L1, Sepedi L1, and isiZulu L1) and Mali (Bamanankan L1, Bomu L1, Ffulfulde L1 and Songhoy L1). They report greater gains in comprehension in the treatment groups, whose teachers benefitted from scripted routines focusing on learning letter sounds, blending sounds into words, recognizing sight words, learning vocabulary and comprehension skills, than in the control groups.

Benjamin Piper and colleagues have made numerous important contributions to our understanding of comprehension skills in the Kenyan context. Piper et al. (2015) find that oral reading comprehension increases in a treatment group benefiting from the provision of instructional materials, teacher guides, teacher training, modeling and practice of new techniques, and ongoing classroom support, in Kiswahili (L2) and English (L3) in Kenya. Although Kiswahili reading speed is systematically slower than in English, and both are worryingly low, comprehension is higher in Kiswahili, irrespective of whether the text is read orally or silently (Piper & Zuilkowski, 2015a, pp. 164–165). Children did not comprehend at a meaningfully higher level in either language when assessment was untimed (Piper & Zuilkowski, 2015b, p. 93). In another study of 2000 grade 3 children in 100 Kenyan schools, Piper et al. (2016, p. 14) show that these children could understand much more of what they read in Dholuo (L1) and Gikuyu (L1) than in English (L3), even though their decoding skills in these languages are weaker than in English. They also understood written Kiswahili (L2) better than written English, even though Kiswahili is not their L1.

As for experimental research on African tone orthographies, it lags far behind the wider world of reading research. Comprehension tasks are not only completely absent from the first generation of research (Badejo, 1989; Bernard et al., 2002; Bird,

1. The language of formal education in Liberia is English, but all the teachers in this project used both Liberian and Standard English in their classrooms. In many areas of Liberia, communities have some exposure to Liberian English, but it is not the L1 for many Liberians (Marcia Davidson, p. c.).

1999; Essien, 1977; Fagborun, 1989; Klem, 1982; Mfonyam, 1989),² but also from our own more recent contributions (Roberts et al., 2016; Roberts & Walter, 2012, 2016). The present chapter, therefore, represents a new departure by introducing a comprehension measure as a major component into an African tone orthography experiment for the first time.

The chapter reports on the results of the oral reading comprehension task (see p. 194) in seven of the focal languages: Tem, Nateni, Mbelime, Eastern Dan, Yoruba, Idaasha, and Ife.³ After investigating the L2 results (Section 2), we present the overall L1 results (Section 3.1) then break these down by focal language (Section 3.2). We then present a multilevel analysis of the impact of independent variables (Section 3.3) before interpreting and discussing the results (Section 4).

2. L2 oral reading comprehension results

The overall mean L2 COMPREHENSION score is 68.44% (SD 31.76). Figure 1 shows this result broken down by the seven focal languages that participated in this task.⁴ The mean L2 COMPREHENSION scores reveal a high degree of variation by FOCAL LANGUAGE, with scores falling into two clusters: four languages (TEM, MBELIME, NATENI, IFE) have mean rates around the 80% level, while the other three (IDAASHA, YORUBA, EASTERN DAN) group around the 55% level.

Another way of presenting the data is to chart the percentage of participants who answered all three questions correctly on the L2 COMPREHENSION task (Figure 2). In only two languages did more than half of the participants score 100% (TEM 73.68%; NATENI 56.25%). In EASTERN DAN fewer than one in five participants did (19.44%).

2. Bird (1999) appears in this list for the reasons stated on p. 194.

3. The three Bantu languages (ELIP, MMALA and YANGBEN) were excluded from the comprehension measures because the participants in these languages were inadvertently given access to the texts while answering the questions. As a result, many of them located the answers in the text and read them word for word.

4. We do not present the comprehension results in the form of box and whisker graphs as in the other chapters because the small number of questions asked and the high number of correct answers combine to produce a confusing visual impression.

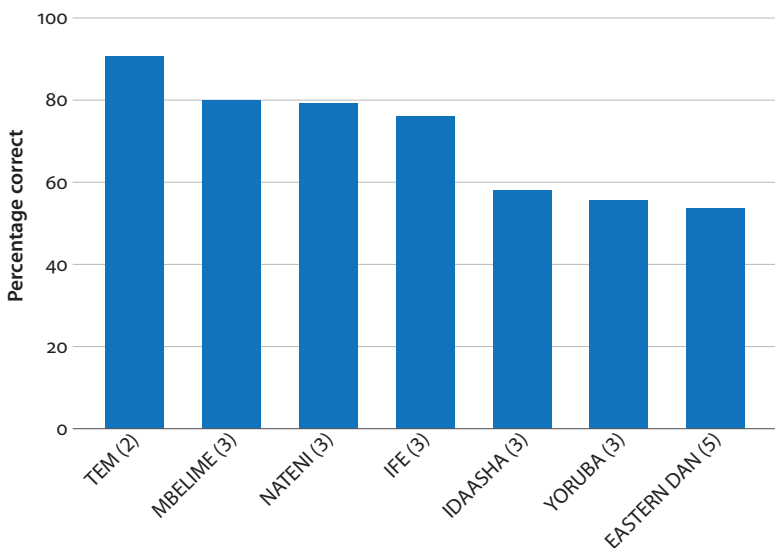


Figure 1. Mean L2 COMPREHENSION by FOCAL LANGUAGE

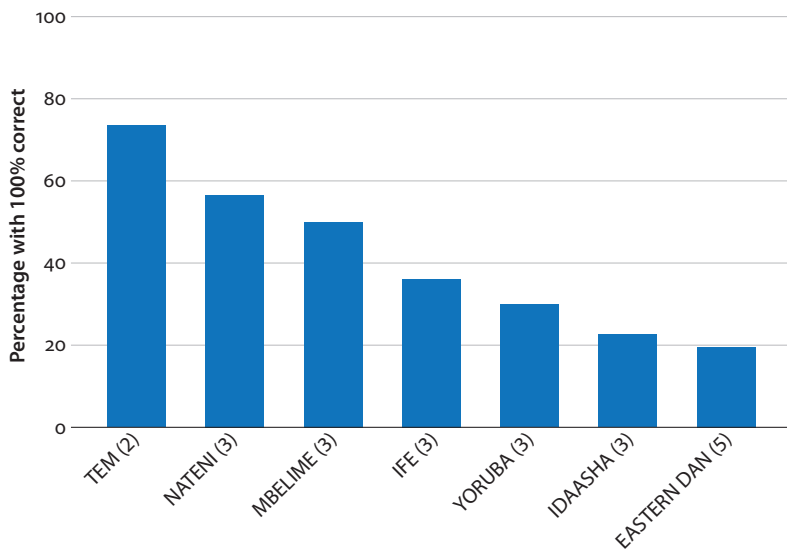


Figure 2. Percentage of participants who scored 100% on the L2 COMPREHENSION task by FOCAL LANGUAGE

Table 1 reports the results of a multiple regression analysis investigating the impact of all demographic variables on L2 COMPREHENSION, with YORUBA embedded in the constant.

Table 1. Demographic variables impacting L2 COMPREHENSION

| | Coef | t | p | Impact (Q3) |
|----------------|--------|-------|-------|-------------|
| Constant | 87.99 | 10.72 | 0.000 | 87.99 |
| AGE | -0.43 | -2.21 | 0.028 | -20.30 |
| FOCAL LANGUAGE | | | | |
| EASTERN DAN | -13.01 | -2.70 | 0.008 | -13.01 |
| IDAASHA | -13.46 | -2.75 | 0.007 | -13.46 |
| IFE | 7.49 | 0.99 | 0.322 | 7.49 |
| MBELIME | 7.83 | 1.00 | 0.320 | 7.83 |
| NATENI | 8.98 | 1.41 | 0.160 | 8.98 |
| TEM | 20.24 | 4.46 | 0.000 | 20.24 |
| GROUP (1) | 5.64 | 2.61 | 0.010 | 5.64 |

In addition to the FOCAL LANGUAGE variable itself, which accounts for about 80% of all the variance in the model, two other variables have an impact. First, AGE proves to be a negative predictor, with each additional year reducing L2 COMPREHENSION by about 0.5%. Second, participants in GROUP 1 had, on average, an 11% comprehension advantage over those in GROUP 2, indicating an unfortunate imbalance in group assignment. This is particularly marked in EASTERN DAN where GROUP 1 scored an average of about 30% more than GROUP 2. This model as a whole is quite robust, accounting for a sizeable proportion of the variance in the data ($R^2 = 23.37\%$).

Three variables are noticeable by their absence in Table 1: We found virtually no correlation between L2 COMPREHENSION and L2 SPEED, L2 ERRORS or EDUCATION (Table 2), in spite of strong correlations between these latter three variables (see pages 213 and 228).

Table 2. Lack of correlation between L2 COMPREHENSION and L2 reading skills

| | r | f | p |
|-------------------------------|------|------|-------|
| L2 COMPREHENSION VS L2 SPEED | 0.04 | 0.50 | 0.479 |
| L2 COMPREHENSION VS L2 ERRORS | 0.0 | 0.00 | 0.959 |
| L2 COMPREHENSION VS EDUCATION | 0.0 | 0.02 | 0.899 |

3. L1 oral reading comprehension

3.1 Overall results

Mean L1 COMPREHENSION is systematically higher on the FULL TONE texts. A t-test of group means comparing performance at the individual level when reading ZERO TONE and FULL TONE texts reveals that FULL TONE marking significantly improves L1 COMPREHENSION (ZERO TONE 69.8%, $SD = 24.08$; FULL TONE 77.48%, $SD = 22.27$).⁵ The difference is large enough to be statistically significant ($t = 3.67$; $p = 0.000$), but the effect size is very modest (Cohen's $d = 0.33$).⁶

In a linear regression, the correlation between L1 COMPREHENSION of ZERO TONE and FULL TONE texts is 0.41 and is statistically significant ($F(1,243) = 48.48$; $p = 0.000$). However, the correlation between L1 COMPREHENSION of FULL TONE texts and L2 COMPREHENSION is only slightly less at 0.35 ($F(1, 165)$; $p = 0.000$). A paired sample t-test of bilingual participants reveals that L1 COMPREHENSION of ZERO TONE texts is almost exactly equivalent to that of L2 COMPREHENSION (L1 ZERO TONE = 70.66%; L2 = 68.66%; $p = 0.460$), but that L1 COMPREHENSION of FULL TONE texts has an advantage over L2 COMPREHENSION (L1 FULL TONE = 77.84%; L2 = 68.66%; $p = 0.000$).

In both conditions, F tests reveal strong statistically significant correlations between L1 COMPREHENSION and all three measures of L1 fluency irrespective of whether tone is marked (Table 3).

Table 3. Correlations between L1 COMPREHENSION and L1 reading skills

| | ZERO TONE | | | FULL TONE | | |
|---|-----------|-------|-------|-----------|-------|-------|
| | r | f | p | r | f | p |
| L1 COMPREHENSION VS L1SPEED | 0.28 | 20.30 | 0.000 | 0.36 | 36.74 | 0.000 |
| L1 COMPREHENSION VS L1GENERAL ERRORS | -0.29 | 19.13 | 0.000 | -0.36 | 35.27 | 0.000 |
| L1 COMPREHENSION VS L1 TONAL ERRORS | -0.45 | 51.81 | 0.000 | -0.51 | 81.28 | 0.000 |

5. GROUP 1 has an 11% advantage over GROUP 2. Female participants show a sizable advantage over males, with the difference coming close to statistical significance on the ZERO TONE texts ($p = .0635$). This difference can partly be accounted for by the fact the female participants benefit from an additional half-year of EDUCATION.

6. A Cohen's D value of 0.2 indicates a weak effect size, while 0.5 is moderate and 0.8 is strong.

3.2 Language specific results

Figure 3 reports mean L1 COMPREHENSION levels on ZERO TONE and FULL TONE texts, breaking down the results by FOCAL LANGUAGE.

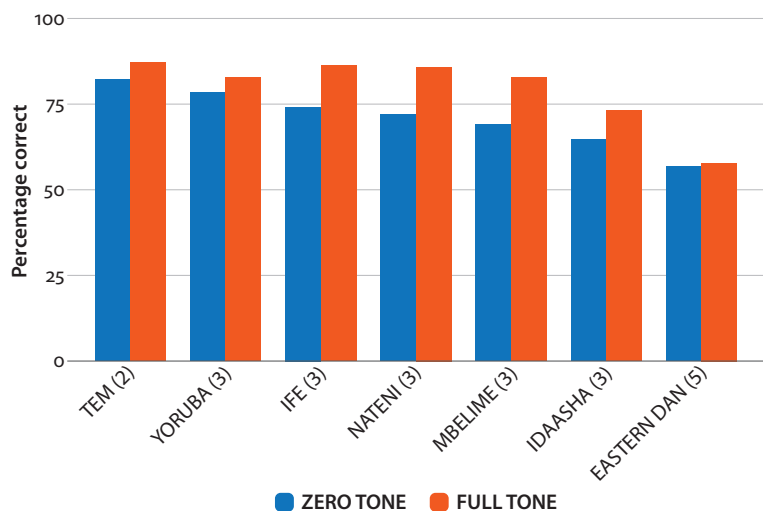


Figure 3. Mean L1 COMPREHENSION ON ZERO TONE and FULL TONE texts by FOCAL LANGUAGE

Irrespective of whether tone is marked, L1 COMPREHENSION is highest in TEM and lowest in EASTERN DAN, shadowing the L2 COMPREHENSION results (p. 254). Taken together, all seven focal languages show some improvement when tone is marked ($p = 0.000$), but with considerable variability between languages. Three show a statistically significant advantage for FULL TONE texts (MBELIME 13.90%, $p = 0.036$; NATENI 13.82%, $p = 0.005$; IFE 12.07%, $p = 0.018$), and one more shows modest improvement but fails to achieve the significance threshold (IDAASHA 8.34%, $p = 0.081$).

All the languages (except, marginally, TEM) score higher on the FULL TONE L1 texts than they do on the L2 text and this is the first reading outcome measured in our study in which this is the case. In four languages (MBELIME, IFE, NATENI, TEM), comprehension of the ZERO TONE texts is below that of L2 texts, while in three cases (EASTERN DAN, IDAASHA, YORUBA) it is above. In YORUBA comprehension is significantly higher on the ZERO TONE L1 text than on the L2 text (L1 ZERO TONE = 78.40%; L1 FULL TONE = 82.72%; L2 = 55.57%, $p = 0.006$). An ANOVA model for the FULL TONE texts accounts for more than twice as much variance as a similar model for the ZERO TONE texts (FULL TONE: $F = 14.00$, $p = 0.0000$, $R^2 = 24.22\%$; ZERO TONE: $F = 6.25$, $p = 0.000$, $R^2 = 11.43\%$), so it is a more robust account of the data.

We also investigated the L1 COMPREHENSION results in terms of gains and losses when tone is fully marked. Figure 4 reports the results broken down by FOCAL LANGUAGE.

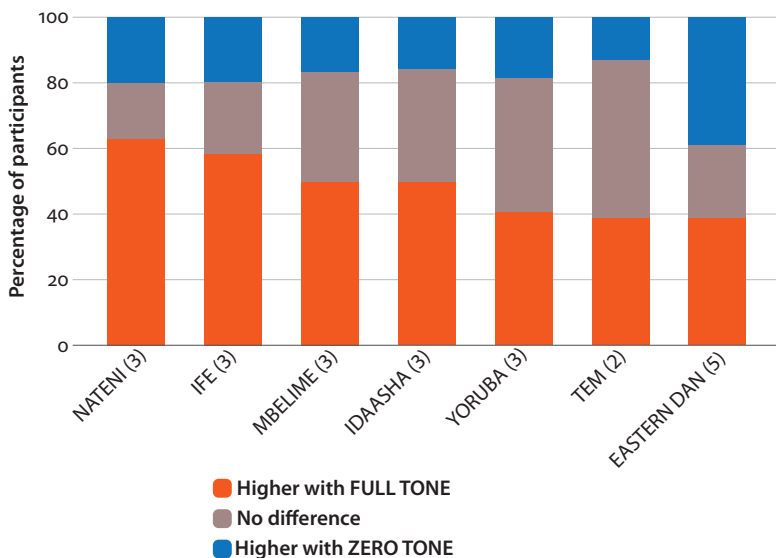


Figure 4. Group level gains and losses in L1 COMPREHENSION by FOCAL LANGUAGE

In only two languages did a majority of participants improve in L1 COMPREHENSION when reading the FULL TONE texts (NATENI 63%; IFE 59%). All the languages, but especially YORUBA and TEM, have a sizeable group for whom the presence or absence of FULL TONE marking makes no difference to L1 COMPREHENSION. In YORUBA, the size of this group is exactly equivalent to the size of the group who improved when reading FULL TONE texts (41%). TEM, on the other hand, is the only language with a larger group who experienced no change in L1 COMPREHENSION when tone is fully marked (47%) than the group who experienced an improvement when FULL TONE is marked (39%). The one really atypical case is that of EASTERN DAN, which had just as many participants with higher L1 COMPREHENSION reading the ZERO TONE texts as FULL TONE texts (39%). In all other cases, L1 COMPREHENSION was higher reading the FULL TONE texts. Overall, 22% of participants actually showed an improvement in L1 COMPREHENSION on ZERO TONE texts, and another 30% showed the same level of L1 COMPREHENSION irrespective of how tone was marked. Less than half of all participants (48%) showed a gain in L1 COMPREHENSION on FULL TONE texts.

So far this chapter has focused on a basic comparison between L1 COMPREHENSION of ZERO TONE and FULL TONE texts, taking both overall and language specific results into account. But to complete the picture, it is also important to investigate whether any of the independent variables contributed to the outcomes.

3.3 Impact of independent variables

As in previous chapters, we begin with the assumption that any difference in L1 COMPREHENSION between ZERO TONE and FULL TONE texts is due to tone marking. Then, if it turns out that factors other than full tone marking explain some or all of the difference, this will weaken that assumption. Table 4 reports the most parsimonious multilevel model explaining the impact of independent variables on L1 COMPREHENSION of FULL TONE texts.⁷

Table 4. Most parsimonious multilevel model explaining impact of independent variables on L1 COMPREHENSION when reading FULL TONE texts

| Level 2 | Type | Variables | Coefficients | <i>z</i> | <i>p</i> |
|---------|------------|------------------------|--------------|----------|----------|
| 2 | Linguistic | WORD LENGTH | 37.94 | 7.64 | 0.000 |
| 2 | Linguistic | TONE DIACRITIC DENSITY | 0.97 | 5.28 | 0.000 |

The model consists of two level 2 variables, both of which describe the linguistic profile of the language and its orthography. The dominance of level 2 was anticipated when we found that, in models consisting exclusively of level 1 variables, not one was statistically significant even when the model was reduced to a single variable.

Table 5 extends the model to an exploration of the impact of the individual variables in the model via their coefficients.⁸

Table 5. Estimated impact of independent variables based at the minimum, mean and maximum levels of performance on L1 COMPREHENSION when reading FULL TONE texts

| | Coefficient | Values in the data | | | Estimated impacts | | |
|------------------------|-------------|--------------------|-------|------|-------------------|-------|--------|
| | | Min | Mean | Max | Min | Mean | Max |
| WORD LENGTH | 37.94 | 1.33 | 1.90 | 2.8 | 44.91 | 72.09 | 106.23 |
| TONE DIACRITIC DENSITY | .97 | 33.77 | 55.98 | 73.8 | 32.76 | 54.30 | 71.59 |

7. A parallel ZERO TONE model retains the same variables which is unsurprising given the relatively high correlation between FULL TONE and ZERO TONE on the measure of L1 COMPREHENSION (See p. 257). However, the FULL TONE model has greater impact than the ZERO TONE model.

8. In one case, the maximum estimated impact exceeds 100%. A regression model does not have any way of knowing that this is meaningless. The model has to be understood as being constrained to a world in which comprehension can only vary between 0 and 100%.

In this model, the impact of each variable is estimated by multiplying the coefficient by a given value of that variable. Columns 3–5 report the lowest observed value, the mean value, and highest observed value respectively of each variable in the model, while columns 6–8 show the corresponding estimated impact at each of these three levels. Table 6 provides further details on how the model fits the data.

Table 6. Assessing model fit of L1 COMPREHENSION when reading FULL TONE texts with cumulative addition of independent variables

| | Log likelihood | AIC | BIC | Overall variance | |
|--------------------------|----------------|---------|---------|------------------|-------------|
| | | | | Explained | Unexplained |
| Null | -1081.75 | 2169.49 | 2179.99 | 0% | 100.00% |
| + WORD LENGTH | -1079.81 | 2167.62 | 2181.62 | 12.86% | 87.14% |
| + TONE DIACRITIC DENSITY | -1074.71 | 2159.43 | 2176.93 | 23.45% | 76.55% |

The null model contains no independent variables but does recognize that participants come from different language communities (the level 2 units). It does not explain any variation in the data but it does demonstrate that some of the variation in the data can be attributed to the level 2 units. In general, a model is considered to provide a better fit if it reduces the amount of unexplained variance in the dependent variable. In columns 2, 3 and 4, the declining values of three technical measures indicate progressive improvement in model fit as relevant variables are added. Column 5 reports this in percentage terms with more and more variance being accounted for by the cumulative addition of variables. The complete model accounts for 23.45% of total model variance. In fact, virtually all of this is level 2 variance since the two retained terms are both level 2 variables.

One more series of tests will bring the statistical analysis of L1 COMPREHENSION to completion. EASTERN DAN has already been identified as a linguistic, orthographic and social outlier (p. 201), and this is matched by poor L1 COMPREHENSION scores irrespective of how tone was marked. It therefore seemed prudent to compare multilevel models that included and excluded the EASTERN DAN data (Table 7).

Table 7. L1 COMPREHENSION when reading FULL TONE texts with and without EASTERN DAN

| | Sample mean | Raw variance | % variance explained | Improvement in model fit |
|----------------------|-------------|--------------|----------------------|--------------------------|
| All data | 77.48% | 496.14 | 23.45% | n/a |
| EASTERN DAN excluded | 83.07% | 305.49 | 2.85% | -87.85% |

The model accounts for 23.45% of raw variance in the full dataset. When EASTERN DAN is removed, the amount of overall variance drops considerably to 2.85%, and the terms in the model become statistically non-significant. This suggests that the profile of L1 COMPREHENSION in EASTERN DAN contrasts significantly with that of the remaining data set. A closer examination revealed a marked over-representation of low comprehension among speakers of EASTERN DAN – 81% of all participants scored below 50%. We are thus led to the conclusion that the proposed model is, in fact, dependent upon the presence of the EASTERN DAN data, and without it, the model loses most of its explanatory utility. This is indicated in Table 7 by the negative indicator of model fit.

We also explored another, slightly less persuasive model that retained the ethno-literacy variables L1 LANGUAGE DEVELOPMENT and L1 LITERACY HISTORY. The resultant analysis showed that removing EASTERN DAN also rendered these variables non-significant statistically and did little to improve model fit. In other words, when this outlier language is excluded, we are unable to construct a satisfactory multilevel model of L1 COMPREHENSION with the independent variables we have identified.

4. Interpretation and discussion

The evidence from the comprehension data is less clear than in the cases of speed and accuracy, and this may be for several reasons. First, there is less data because only seven languages were tested and only three questions were associated with each text. Second, assessing comprehension in reading research has always been fraught with more challenges than assessing speed and accuracy, and this is the first attempt to measure it in a tone orthography experiment to our knowledge. Third, the extreme variation in mean rates of comprehension at the level of language communities (with Eastern Dan, in particular, being identified as an outlier) hints at the presence of historical, social or cultural factors that were not part of the research design. Fourth, our measures of individual experience with L1 literacy were quite broad.

These methodological concerns notwithstanding, comprehension is the fundamental objective of reading and this gives it a certain measure of privilege with respect to those factors that impact it. Furthermore, in contrast to measures such as speed or accuracy, comprehension is impacted by the fundamental issue of language match. While knowing the language of a text does not guarantee comprehension, not knowing it does guarantee lack of comprehension. In our study, comprehension is the first measure encountered in which the level of performance is higher in the L1 than in the L2. Participants understood the L1 texts better than

the L2 text and there is a wider scatter of data in the latter. It is highly likely that this finding reflects the role that knowledge of a language plays in being able to extract meaning from a text.

As noted earlier in the chapter, research has established a strong link between oral reading fluency and comprehension. However, much of this research is based on the evidence of reading instruction among WEIRD children. Implicit in much of the reported research are the assumptions that the learner is a proficient speaker of the language being read, and/or that the proposed link is not affected much (if at all) by language asymmetries between children, teachers, and the text. Our data challenge these assumptions.

On the one hand, L2 comprehension is strikingly independent of speed, error rate and education level. A higher level of formal education leads to faster L2 oral reading (see p. 213) but, worryingly, this does not contribute to L2 comprehension. This tendency is most striking in Yoruba, but is present in all the focal languages that were tested on this measure. It is the Tem participants who score highest and the Eastern Dan lowest on comprehension of the L2 text, yet these two focal languages score neither outstandingly well nor poorly in terms of speed or accuracy on this text. Mean overall L2 oral reading speed for those who correctly answered none or all of the questions correctly was almost identical.

In complete contrast, L1 comprehension is tethered to speed and accuracy although even here perhaps not as strongly as might be expected. Formal education does not crop up in the multilevel analysis, but it does not go unnoticed that the Tem, who have one of the highest levels of education, also have the highest L1 comprehension scores, and it is also the only language in which L2 scores are higher than either L1 experimental condition. As for the Yoruba, if they understand the L1 texts with no tone marks better than the L2 text, it is surely because Yoruba is taught in schools, and learners have multiple opportunities to practice their reading skills. They are less reliant on the official language than any other participants.

These data support a less direct relationship between oral reading fluency and comprehension in the L2 than in the L1. It is possible that this particular data set obscures the relationship between the two variables because most participants were relatively well educated in their L2 as well as being literate in their L1. On the other hand, our findings may serve to test assumptions about the interpretation of reading research data based on reading in a second language. There may well be a need to refine existing assessment models in multilingual settings by giving serious and appropriate attention to the role that language itself plays in the development of reading skills, especially in non-WEIRD societies.

Now let us turn to a comparison between L1 performance on full tone and zero tone texts. Participants read the former with greater understanding than the latter, although the differences are not dramatic and vary greatly between languages.

Marking tone fully delivers a statistically significant improvement over its absence in Mbelime, Nateni, Ife and perhaps in Idaasha. One might be tempted to trace a linguistic effect here, since all these languages have three phonemic level tones. Yet Yoruba also has three tones and comprehension in this language does not benefit from full tone marking.

Full tone marking is beneficial for comprehension to the majority of participants, particularly in Nateni and Ife, but leads to a decline for some and makes no difference at all for others. The sizeable proportion in the latter group – and this remark applies particularly to Tem and Yoruba – suggests that many readers are paying no attention at all to tone marks to extract meaning from the text. One plausible explanation for the pattern of performance on comprehension gains and losses is that the value of tone marking is broadly related to how well an individual can read. Less capable readers apparently rely on full tone marking to understand a text, while more experienced readers appear not to need them, need them less, or even find them a hindrance (cf. Bird, 1999).

For bilingual readers, especially in Mbelime, Nateni, Ife, and possibly Idaasha, comprehension of texts with no tone marks is almost identical to comprehension of the L2 text. Quite literally, for these participants, when a text contains no tone marks it may as well be a foreign language. Fully tone marked texts, on the other hand, are systematically better understood than the L2 text, though the gains are only modest.

The particularly disappointing Eastern Dan results suggest that, in this language, if comprehension is already poor on texts with no tone marks, it is not likely to get much better by adding them. The data point to low L1 and L2 literacy skills across the board compared to the other focal languages. Idaasha also performs poorly on the L1 comprehension measure. It may be no coincidence that this is also the language of the seven reported in this chapter with the shortest literacy history and the smallest amount of published literature. Comprehension comes through massive exposure to print, and this is not yet available in the Idaasha community.

The moderate correlation between the two experimental conditions indicates, as for the other oral reading measures, that other factors may be responsible for the variation in the data. So what about the contribution of independent variables? This is the first time in the wider analysis that a multilevel model has been restricted to level 2 linguistic variables, and only the second time in the wider analysis that such variables have been identified as impacting performance at all.

The first retained variable is word length. The language community with the highest mean L1 comprehension speaks the language with the longest words (Tem) and the one with the lowest mean L1 comprehension speaks the language with the shortest words (Eastern Dan). If this finding is not coincidental, which is certainly

a possibility, it could be of great interest to linguists, educators, and reading specialists. Could it be that largely monosyllabic languages tend to impede comprehension because the shorter a word the more likely it is to be ambiguous, especially if tone is unmarked? The presence of the second retained variable, tone diacritic density, is harder to explain and is likely to be merely an artefact of the small number of level 2 data points and the presence of an outlier language (Eastern Dan).

It is surprising that no literacy variables are identified as impacting comprehension. An individual's length of experience with L1 literacy and a language community's vision, leadership and resources for ongoing L1 language development both have an impact on speed (p. 217) and general accuracy (p. 232) but we found no evidence that either of these factors contribute to L1 comprehension. Similarly, the addition of a proxy measure of reading skill such as reading speed does not provide a large increase in the amount of level 1 variance accounted for, and this is in contrast to other measures of performance. We are therefore forced to accept that the research design did not succeed in identifying (or perhaps did not adequately measure) variables that adequately account for level 1 variance in L1 COMPREHENSION. Improved instruments for measuring comprehension and larger datasets might yield more credible models.

Tone orthography and tone writing accuracy (*David Roberts, Stephen L. Walter*)

1. Introduction

Writing is a complex activity involving the mastery of numerous sub-skills. *Legibility* – letter formation, spacing, alignment and size – is important not just aesthetically but because an illegible text will impede communication. *Motor dexterity* – grip of the writing tool, pressure on the page or keyboard and speed (i.e. productivity) – is also crucial. Such proficiencies develop in tandem with *cognitive skills* such as reasoning, creativity, expressiveness, communicative capacity, planning, evaluation, memory, attention and concentration (Tsai et al., 2011, pp. 75–76). *Spelling* involves the correct application of grapheme-phoneme correspondences, use of capitals, punctuation and word boundaries. This chapter focuses on only this latter sub-skill, and within that, only the correct placement of tone diacritics.

Throughout the 20th century, research on writing tended to be overlooked as most psycholinguists focused their attention on reading, notwithstanding the work of pioneers such as Guiles (1943). However, since the turn of the millennium there has been an explosion of interest, marked by the founding of two new journals (the *Journal of Second Language Writing* in 1992; the *Journal of Writing Research* in 2008) and a landmark series *Studies in Writing*¹ in addition to multiple individual contributions.

This recent literature is also characterized by a much broader spread of languages and scripts than was hitherto the case. Several studies focus on morphological awareness, investigating English (McCutchen & Stull, 2015), Turkish (Babayigit & Stainthorp, 2010) Italian (Angelelli et al., 2014), Spanish (Defior et al., 2008), and Finnish (Lehtonen & Bryant, 2005). This topic inevitably evokes the question of orthographic depth in these languages, which is further investigated in Korean (Kim & Petscher, 2013) and Norwegian (Rønneberg & Torrance, 2017). Still others deal with grain size in Thai (Winkel & Iemwanthong, 2010) and attention deficit in Italian (Moretti et al., 2003) and Chinese (Tsai et al., 2011).

1. Published by Kluwer academic. <https://www.springer.com/series/6604?detailsPage=titles> (accessed 27 January 2021).

The literature contains a wide range of writing tasks including dictation (Angelelli et al., 2014), cloze tests (Fuchs et al., 1988), maze tests (Price et al., 2016), proof-reading (Dixon & Kaminska, 2007), creative writing (Fazio, 2001), morphological manipulation (McCutchen & Stull, 2015), copying (Dixon & Kaminska, 2007), and dividing letter strings into words (Price et al., 2016; Rønneberg & Torrance, 2017). It is common for researchers to focus on only one aspect of the writing task, as we will do in this chapter. McCutchen & Stull (2015) count morphological inventions (e.g. *solidize* instead of *solidify*) separately from other spelling errors. Fazio (2001) scores only agreement markers in her study of journal writing among French speakers in Quebec.

Two experiments on Pinyin – the Chinese romanization used in mainland China for L1 early grade and L2 literacy – are of particular interest because they include writing tasks, and because Pinyin encodes tone exhaustively and transparently. Lin et al. (2010) administer a dictation task to 296 L1 Mandarin kindergarteners revealing that performance on Pinyin dictation was uniquely predictive of Chinese word reading twelve months later, and underscoring the importance of Pinyin instruction in early literacy development. Li et al. (2014) investigate perception and production of Mandarin tones by 16 Cantonese learners. In one task, participants were presented with a set of toneless Pinyin two-syllable phrases and asked to add tone on the second syllable (as numbers in final position)² after listening to stimuli. In another task, participants were asked to choose the words they heard from two written options reproduced in traditional Chinese characters. Participants made fewer errors with Chinese characters than with Pinyin; however, as the authors admit, the two tasks involve different processing styles and are therefore not easily comparable.

The Thai orthography is of interest because, like the focal languages in our series of experiments, it represents tone fully and phonographically. In a dictation task with monosyllabic words and non-words among 60 Thai children, Winskel & Iemwanthong (2010) find that, in spite of rapid development between grades 1 and 2, tonal errors persist in older children, errors which the authors attribute to the irregular and complex representation of tone in the orthography.

Turning to Africa, most of the current research on literacy outcomes focuses on reading, but we are aware of two experiments that include writing components, both of which investigate quality of instruction. Jukes et al. (2017) report an experiment involving 2500 grade 1 children in 101 Kenyan schools. The treatment group, whose teachers benefited from semi-scripted lessons, training, and weekly text message support, had significantly higher mean scores on an English (L2 or L3)

2. This is one of two available strategies for marking tone in Pinyin. For further details, see p. 238, footnote 1.

spelling task than those in a control group after nine months, but this advantage was not sustained after 24 months (p. 465). Lucas et al. (2014) ran an experiment in 109 schools in Uganda (Lango L1)³ and 112 schools in Kenya (Swahili L2) to test a scaffolding approach,⁴ the assessment of which included writing tasks. The treatment groups increased in competence in Uganda but not in Kenya (p 951, 962, 972), leading the authors to suppose that the difference between the two countries may plausibly be attributable to a mismatch in Kenya between the languages of instruction (English L3) and assessment (Swahili L2).⁵ As for Lango, it is a tone language, but tone orthography is not the researchers' focus of attention. We must turn elsewhere for experiments that specifically investigate competency in writing tone.

Three experiments on Grassfields languages of Cameroon – Dschang (Bird, 1999b, p. 96), Bafut and Limbum (Mfonyam, 1989, pp. 331–333, 464, 467) – required participants to add accents to zero tone texts, as is the case in our series of experiment. Although somewhat unnatural, this task has the advantage of isolating the object of interest, and in this sense it can be viewed as the written equivalent of having an informant whistle tone patterns when orally eliciting linguistic data. In Bafut, Mfonyam pits four experimental orthographies against each other, which are varied in terms of depth and graphic density. He terms them Stable, Basic, Minimal and Surface. In an essay writing task, those writing the Surface orthography score almost half (35.0%) of those writing the Stable (63.3%) and Basic (63.3%) orthographies. No results are reported for the Minimal orthography because these participants failed to mark any tone at all. As for the task of adding accents to a zero tone text, the Stable orthography – which marks L tone because it is the least mobile – scored the highest, but the results are far from spectacular (72.31%). Those writing the Surface orthography, although it succeeds in eliminating more written ambiguity than any of the others, had the lowest score (41.7%), and provoked the strongest negative reaction from participants.⁶ The Limbum experiment shadowed the design of the Bafut experiment, but omitted spontaneous writing. The results of the task involving the addition of tone diacritics are higher than in Bafut

3. In fact, although the authors state that Lango is the language of instruction in the tested Uganda schools, they do not specify whether it is the L1 of all the Ugandan participants.

4. Specifically, the Reading to Learn (RTL) method: <https://readingtolearnsouthafrica.weebly.com> (accessed 27 January 2021).

5. Despite the official government policy of using Swahili as the language of instruction, Kenyan teachers often revert to English, relegating Swahili to as little as 30 minutes a day, which is insufficient time to apply the method under consideration (Lucas et al., 2014, p. 951).

6. The Bafut and Limbum pedagogical materials also include translation exercises from English and the completion of incomplete sentences, but these tasks were not included in the final tests (Mfonyam, 1989, pp. 576–669).

overall, but the same pattern emerges with the Stable orthography scoring highest again (92.95%). Bird (1999b, p. 100) divides the Dschang writing results into two clusters: “experienced” and “inexperienced”. The average score of the experienced participants is 73.1% (note the similarity with Bafut), and the performance of inexperienced participants is a mere 53%.

Fagbörün’s (1989) experiment – which deserves special attention because Yoruba is one of the focal languages in our series of experiments – consists solely of a dictation task. A text was distributed to Yoruba university lecturers, with instructions to dictate it to students studying Yoruba language and literature. Responses were collected and each student’s tone markings were charted against the master text written in the standard orthography. The results reveal a disconcerting disparity between *de jure* conventions and *de facto* practice. Thirteen students, representing half the sample, scored under 50% and no student obtained more than 73%. Fagbörün concludes that tone marks are commonly perceived as being incidental to spelling and that the younger generation is probably aware neither of the rules governing their application nor their purpose.

Two experiments on the Kabiye orthography involve writing tasks. Roberts & Walter (2012), in an experiment with 55 adult participants that included dictation and spontaneous writing tasks, find that writers of an experimental orthography that highlights the grammar perform faster and more accurately than writers of an experimental orthography that represents phonemic tone fully. Following this, Roberts et al. (2016) use a dictation task with 97 secondary school pupils to assess three levels of orthographic depth. The results support the hypothesis that the output of the lexical phonology is the most promising level of orthographic depth for a full representation of tone by means of diacritics in the orthography of a tone language.

The following sections set forth the results emerging from the writing task (see p. 195), so the term “writing accuracy” will be used to refer only to performance on the specific task of adding tone marks to zero tone texts, not to general writing skills. First, we present the results of the statistical analysis both in terms of overall results (Section 2.1) and language specific results (Section 2.2). We pause to examine correlations between writing and reading (Section 2.3), then proceed to a multilevel analysis investigating the contribution of independent variables (Section 2.4). Section 3 is our interpretation of the results with some discussion about the implications for tone orthography development.

2. Tone writing accuracy

2.1 Overall results

The TONE WRITING variable measured correct choices writing a diacritic where there should be one on the ZERO TONE versions of the L1 texts as a percentage of those treated (for an explanation of this choice, see p. 198). Figure 1 is a stacked bar graph showing the percentage of the TONE WRITING task that was completed by the speakers of each of the ten participating languages.⁷

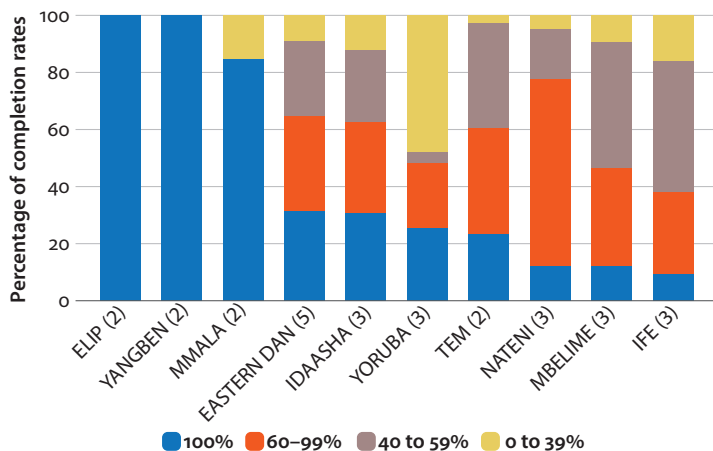


Figure 1. Percentage of TONE WRITING task completed

Although some participants completed the task (35% of the sample, including all the ELIP and YANGBEN participants), most did not. Eleven YORUBA and three MMALA participants did not even attempt it, yet we are confident that they understood the instructions. Since we have reasonable grounds for believing that their non-performance was due to lack of ability, we scored these as zero rather than as missing data. They were typically FEMALE participants with fewer years of L1 EXPERIENCE than the means for their respective languages, and who also read and wrote their language less frequently.

7. When comparing productivity, it needs to be borne in mind that the texts, being translations, vary in length from language to language (see p. 192). Also, in this analysis, contrary to those presented in the previous chapters, we paired the texts for lack of any particular reason to separate them in what was essentially a single twenty-minute task. A two-sample t-test of the results confirmed that the two pairs of texts were of equal difficulty.

Overall, participants wrote about 60% of the tone marks correctly. A histogram of the TONE WRITING performance variable reveals an unusual distribution (Figure 2). Although no one scored 100% and only eight participants scored 97.5–100%, about a third of the sample scored between 87.5–97.5% success. Among those who scored below this level, scores are fairly evenly distributed across all percentage bands from 2.5–82.5%.

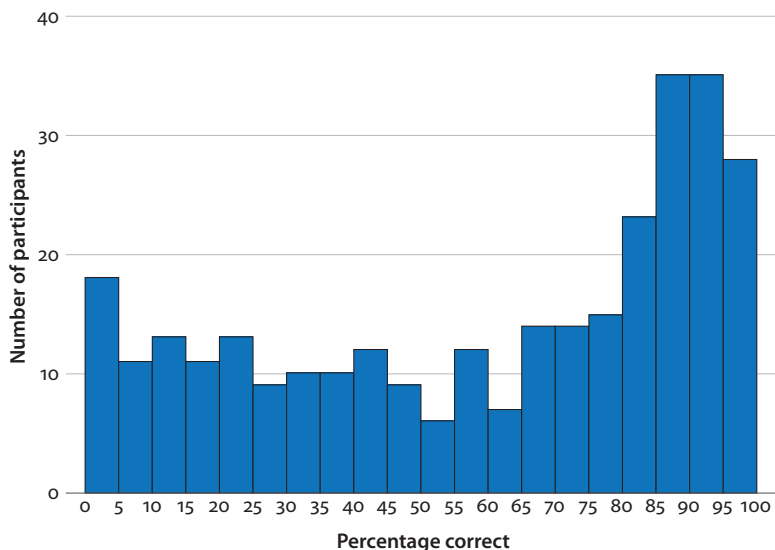


Figure 2. Distribution of TONE WRITING accuracy

2.2 Language specific results

Figure 3 breaks down the overall TONE WRITING results by FOCAL LANGUAGE. The scores are extremely varied, especially in the languages of middle ranging competence (TEM, EASTERN DAN, IDAASHA, MMALA), but also in YORUBA. The three languages with the highest mean scores are IFE (81.91%), NATENI (78.43%) and MBELIME (68.69%). Only eight participants scored in the top 97.5–100% range (NATENI 3; IFE 2; MMALA 2; IDAASHA 1), and the 87.5–97.5% success range is also dominated by IFE (22) and NATENI (18). At the other extreme, two languages, ELIP and YANGBEN score 30% or lower (30.15% and 19.56% respectively); their MMALA cousins fare better (54.08%). ELIP and YANGBEN are entirely absent from the >87.5% scores.

The YORUBA participants, although they read with comparatively few L1 TONAL ERRORS, irrespective of whether tone is marked, have a particularly wide range of

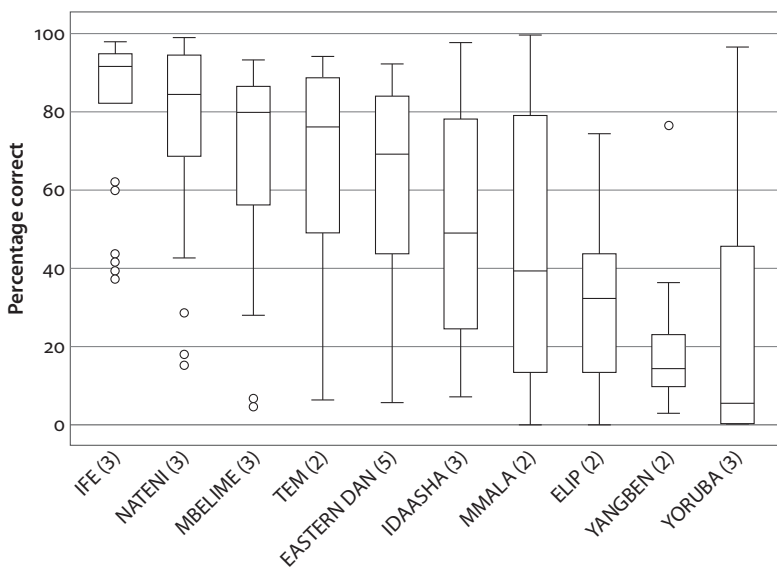


Figure 3. TONE WRITING by FOCAL LANGUAGE

ability when it comes to TONE WRITING (from 0% to 96.34%). Furthermore, their performance profile is quite different from other groups, being responsible for six of the thirteen cases in which the data deviate from the model. IFE and NATENI, the same two languages that benefit most from the addition of FULL TONE marks in terms of reducing L1 TONAL ERRORS (see pp. 243–244) and improving L1 COMPREHENSION (see p. 258), also score the highest on TONE WRITING.

Investigating participants with low scores (defined as below 50%) on TONE WRITING provides another interesting angle on the data. The distribution is clearly language specific. Three languages – ELIP, YANGBEN and YORUBA – had a majority of participants demonstrating low skills on this measure, in contrast to IFE, NATENI, MBELIME, TEM and EASTERN DAN where clear majorities scored above 50%. Figure 4 reports the percentage of participants in each FOCAL LANGUAGE according to their success rates on TONE WRITING.

IFE is the only language in which over half the participants (58.06%) scored 90% or over. Very few did in MBELIME and EASTERN DAN and no one did in ELIP or YANGBEN.

We also undertook a thorough investigation of various tonal phenomena (up-step in MBELIME, contour tones in MBELIME and NATENI, H tone spread in TEM, non-automatic downstep in ELIP, MMALA and YANGBEN) but found no evidence at all that these minute details systematically attracted more spelling errors than any other orthographic TBUs.

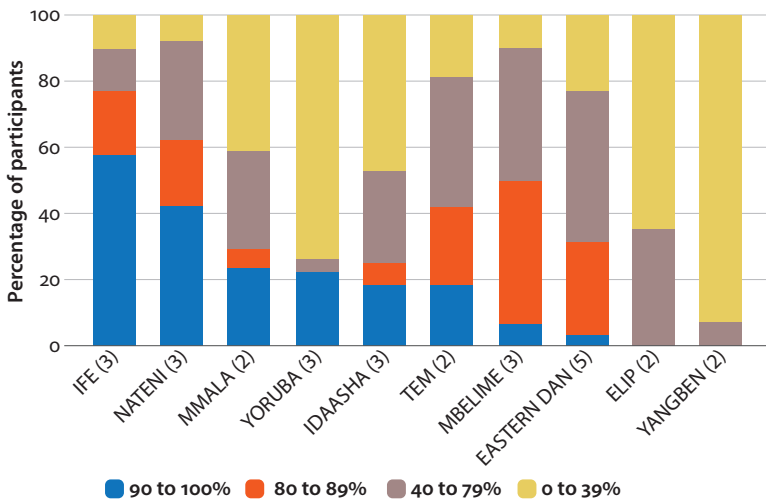


Figure 4. Percentage of participants in each FOCAL LANGUAGE according to their success rates on TONE WRITING

2.3 Correlations between reading and writing

We also investigated correlations between correct TONE WRITING and the various measures of L1 oral reading presented in the preceding chapters (Table 1).

Table 1. Correlations between TONE WRITING and L1 oral reading skills

| | <i>r</i> | <i>f</i> | <i>p</i> |
|-------------------|----------|---------------------|----------|
| L1 SPEED | 0.119 | $F(1, 309) = 4.37$ | 0.038 |
| L1 GENERAL ERRORS | -0.291 | $F(1, 290) = 26.89$ | 0.000 |
| L1 TONAL ERRORS | -0.048 | $F(1, 291) = 0.68$ | 0.409 |
| L1 COMPREHENSION | 0.120 | $F(1, 232) = 4.72$ | 0.061 |

The correlations range from modest to relatively small. The two that are negative are expected as, in each case, the underlying scales of the variables compared run in opposite directions; that is, a participant who orally reads with fewer errors is predicted to have more accurate TONE WRITING skills and vice versa. However, note that the one variable that might be expected to produce the strongest correlation (L1 TONAL ERRORS VS TONE WRITING) is the only one of the four that falls well short of the threshold of statistical significance.

2.4 Impact of independent variables

In this section we identify those independent variables that explain a significant amount of variation on the measure of TONE WRITING accuracy. Settling upon the best model for TONE WRITING required some investigation of a number of competing multilevel models. Ultimately, one containing three independent variables, L1 EXPERIENCE, EDUCATION STATUS, and L1 READING FREQUENCY provided the optimal fit (Table 2).

Table 2. Most parsimonious multilevel model explaining impact of independent variables on TONE WRITING

| Level | Type | Variable | Coefficient | <i>z</i> | <i>p</i> |
|-------|----------------|----------------------|-------------|----------|----------|
| 1 | Demographic | L1 EXPERIENCE | 0.74 | 4.56 | 0.000 |
| 2 | Ethno-literacy | EDUCATION STATUS | -9.69 | 5.12 | 0.000 |
| 1 | Demographic | L1 READING FREQUENCY | 0.02 | 3.17 | 0.002 |

The level 1 demographic variable L1 EXPERIENCE accounts for more variation between participants than any other. The coefficient of 0.74 indicates an increase in TONE WRITING accuracy with each additional year of L1 EXPERIENCE. The negative coefficient of the level 2 ethno-literacy variable EDUCATION STATUS indicates that the higher the status of formal education in the focal language community, the lower the level of TONE WRITING proficiency. As for L1 READING FREQUENCY, it would be tempting to treat it as being very similar to that of L1 EXPERIENCE, but the model indicates that the two are somewhat orthogonal.

Table 3 provides a better idea of the actual and potential impact of these three independent variables on TONE WRITING accuracy.

Table 3. Estimated impact of independent variables at the minimum, mean and maximum levels of performance on TONE WRITING

| | Coefficient | Values in the data | | | Estimated impacts | | |
|----------------------|-------------|--------------------|--------|-----|-------------------|--------|--------|
| | | Min | Mean | Max | Min | Mean | Max |
| L1 EXPERIENCE | 0.74 | 0 | 14.82 | 53 | 0 | 10.97 | 39.22 |
| EDUCATION STATUS | -9.69 | 1 | 3.72 | 7 | -19.38 | -36.00 | -67.82 |
| L1 READING FREQUENCY | 0.02 | 0 | 338.63 | 730 | 0 | 6.10 | 13.14 |

All three variables have substantial impact on TONE WRITING. However, their influence runs in opposite directions with the two level 1 variables having a positive impact and the level 2 variable having a negative impact.

Table 4 gives an indication of model fit for the data on the task of TONE WRITING with the cumulative addition of independent variables.

Table 4. Assessing model fit of TONE WRITING with cumulative addition of independent variables

| | Log likelihood | AIC | BIC | Overall variance | |
|--------------------------|----------------|---------|---------|------------------|-------------|
| | | | | Explained | Unexplained |
| Null | -1444.76 | 2895.53 | 2906.69 | 0% | 100.00% |
| + L1 LITERACY EXPERIENCE | -1412.77 | 2833.54 | 2848.37 | 3.58% | 96.42% |
| + EDUCATION STATUS | -1406.18 | 2822.36 | 2840.90 | 28.19% | 71.81% |
| + L1 READING FREQUENCY | -1392.19 | 2796.38 | 2818.59 | 31.45% | 68.55% |

The total amount of raw variance among participants on this task is 1011.72. Within the framework of a multilevel model, level 2, the language community, accounts for just one third of total individual variance. In practical terms, this means that the ethno-literacy context collectively raises or lowers an individual's performance on the TONE WRITING task enough to account for about one third of the extent to which individual performance varies on this task.

It only remains to investigate whether the EASTERN DAN data has a distorting effect on TONE WRITING, since this language has been identified as a linguistic, orthographic and social outlier (p. 201). Table 5 compares TONE WRITING including and excluding the EASTERN DAN data.

Table 5. TONE WRITING with and without EASTERN DAN

| | Sample mean | Raw variance | % variance explained | Improvement in model fit |
|----------------------|-------------|--------------|----------------------|--------------------------|
| All data | 59.08 | 1011.73 | 31.45% | n/a |
| EASTERN DAN excluded | 58.61 | 1085.71 | 33.41% | 6.24 |

EASTERN DAN participants performed at a level quite similar to that of the other languages (EASTERN DAN 61.11%; other languages 58.61%). Removing EASTERN DAN from the sample results in a modest increase in the amount of variance present in the data (column 3), slightly increases the variance accounted for (column 4), and slightly improves the model fit (column 5). As for the multilevel model, when EASTERN DAN is excluded, it retains the same three variables, but they cease to be statistically significant. This suggests that the Eastern Dan data did weight the model slightly towards the salience of the variables listed in Table 4.

3. Interpretation and discussion

Literacy practitioners in Africa commonly report that learners have considerable difficulty writing full tone correctly. It is not yet clear whether this is due to the inherently complex nature of the tone systems, the choice of orthographic depth to represent them, popular disregard for what is perceived to be a superfluous orthographic convention, or sheer lack of practice.

The extremely wide-ranging scores on the tone writing task provide but scant evidence supporting the claim that full tone marking is necessary in African languages. Most of the scores are worryingly low, echoing Bird's (1999a, p. 100) finding that even experienced Dschang writers do not fully master tone writing, and that "inexperienced writers perform worse than chance when they have to write a high tone".

However, the overall picture hides language specific differences. For example, the Yoruba participants consistently performed quite differently from those in the other focal languages. Firstly, it was one of only two languages (the other being Mmala) in which some participants capitulated: in all the others everyone at least attempted to mark some tone, even if the time limit cut short their efforts. Those Yoruba who did not attempt the task at all were typically females with below average level of L1 literacy experience and who read and write infrequently. Secondly, even those Yoruba who did attempt the writing task scored relatively poorly, and a glaring inconsistency emerges between oral reading and writing: reading tones accurately does not ensure tone writing accuracy. Either the weaker Yoruba literates are not paying attention to tone marks, or teachers are not prioritizing them sufficiently, or full tone marking really is unnecessary.⁸

Elip and Yangben are the only languages in which all the participants finished the task, but it was performed hastily and with poor results. None of them seemed to understand how to write tone at all and they left more and more words unmarked as they struggled on to the end. Is this an indication that literates in these languages do not find marking tone fully to be worth the effort? Or are they under the illusion that diacritics can be added without much thought? Their Mmala cousins fare slightly better, yet we can detect no linguistic reason why these three very

8. During additional fieldwork undertaken by the principal investigator, two male Yoruba university students residing in Kara, Togo, both proficient readers, spontaneously wrote with no tone marks and, when questioned, did not consider them to be important. Matthew Harley (p. c.) concurs that poor tone writing ability is very common in Yoruba, and even more so in the other Nigerian languages that mark tone fully. For example, in Boki and Yala, each of which have at least 150,000 speakers, no more than about three or four people in each language can accurately mark tones.

closely related languages should perform differently from one another: they all have two-tone mobile systems with downstep; they are all agglutinative languages with similar word length. Rather, it seems more likely that the variation is due to the literacy profile of the language communities. Observations during extensive fieldwork are that the Mmala are in general better organized, and their literacy program has had more success than those in Elip and Yangben (Ginger Boyd, p. c.). Still, even in Mmala the writing scores fall far short of anything resembling real competency and this group contained three participants who did not even attempt the task.

The Eastern Dan results may appear unremarkable, sitting as they do exactly in the middle of the focal languages on the measure of writing tone accurately. But this apparently bland result needs to be interpreted in the light of data from the other chapters. Irrespective of whether tone is marked, Eastern Dan read their language with the second to slowest speed (p. 215), the second to most general errors (p. 230), by far the most tonal errors (p. 243), and the least comprehension (p. 258). With such a poor track record, it is rather surprising that the Eastern Dan participants performed as well as they did when writing tone. Yet again, the ethno-literacy context provides the necessary clues to explain this disparity. The Eastern Dan literacy program has always placed a heavy emphasis on learning to write tone accurately, to the point where no written word is considered complete unless it carries the correct tone symbol. It is a question of orthographic position too: the word initial slot reserved for marking tone requires a conscious choice on the part of the writer and is less easy to bypass than a superscript accent.⁹ However, these data provide worrying evidence that this rigorous discipline when writing tone is not then translated into oral reading skills.

The most encouraging tone writing results are from Ife, Nateni and Mbelime, and their proficiency on this measure is in harmony with their oral reading skills. These data are all the more impressive when we recall that these are the three languages with the lowest levels of formal education.

When the entire dataset is examined, three literacy variables are the principle predictors of ability to write tone correctly. Two of these, encoding the length of time an individual participant has been literate in the L1 and how frequently they read it, push up the individual (level 1) scores, underscoring the old maxim that “practice makes perfect.” The other, measuring the status of formal education in the language community, drags down the mean language community (level 2) scores. This suggests that immersion from a young age in a non-tonal L2 (whether

9. The Eastern Dan tone orthography has been reformed in favor of superscript diacritics since the experiment took place. For more detailed information, see Zeh (2018), (Vydrin et al., 2019) and Roberts et al. (2019, p. 342).

it be French or English) trains learners later in life to ignore tone marks when, as adults, they learn how to read and write the L1. This influence extends to almost all the participants in the study and is in marked contrast to the reliably positive impact of formal education on tone writing proficiency identified in two previous experiments (Roberts, 2010, p. 149; Roberts & Walter, 2012, pp. 241, 244). However, the model is slightly weaker when the Eastern Dan data is removed. This could be interpreted in at least two ways, with either or both being possibilities. First, the multilevel model draws most of its validity from the Eastern Dan data. Second, the model still applies across all of the data but in a weak or marginal way.

No linguistic variables are predictive of performance. Measurements of the linguistic profile of a language (e.g. how many phonemic level tones it has) or its orthography (e.g. the level of diacritic density) are apparently irrelevant in terms of predicting how well an individual can write tone, or at least are overshadowed by more important considerations to do with the literacy profile of the individual and the language community to which they belong (cf. L1 Speed (p. 216) and L1 General Accuracy, p. 231).

As for the lack of strong correlations between tone writing and oral reading skills, it is not unexpected. In the African context where L1 literacy is still emerging, writing tends to be much less practiced than in WEIRD societies, and than reading in either setting. More specifically, the lack of correlation between oral reading tonal errors and tone writing on the one hand, and the strong correlation between oral reading tonal errors on full tone and zero tone texts on the other (p. 242) provides further proof that readers and writers do not consider full tone marking to be important and that ability to read fluently and write accurately is largely dependent on a favorable literacy environment.

Epilogue (*David Roberts, JeDene Reeder, Stephen L. Walter*)

1. Introduction

Our research has cast a searchlight over ten Niger-Congo languages representing four major linguistic families across five countries. The ten language communities have strikingly dissimilar ethno-literacy profiles, and the languages themselves represent a wide range of tone systems. The functional load of tone also differs greatly from language to language, as does the orthographical representation of tone.

This chapter takes a look at the research findings one last time, distilling the essential outcomes of the experiments in an overview (Section 2.1), a language-by-language assessment (Section 2.2), a summary of the impact of independent variables (Section 2.3), and our interpretation and discussion of the results (Section 2.4). We pause to address some issues related to tone pedagogy (Section 3) and discuss some experimental design limitations (Section 4), before presenting some concluding remarks about tone orthography experimentation in Africa (Section 5).

2. Evidence from the classroom

2.1 Overview

Our series of experiments delivers no across-the-board evidence that “marking tone reduces fluency” (Bird, 1999), but the high correlations between zero tone and full tone conditions – particularly for speed and accuracy – do suggest that any variation in performance has little to do with how tone is marked. Rather, the data demonstrate dramatic variation by language community and this plays a greater role in predicting performance than how tone is marked.

On the one hand, we have limited evidence in favor of full tone marking in three languages, and marginally in two more. Tone marking positively impacts tone reading accuracy, comprehension, and possibly reading speed in Nateni and Ife; comprehension and possibly tone reading accuracy in Mbelime; possibly general reading accuracy in Nateni and Eastern Dan, and possibly comprehension in Idaasha. However, it is important to underline how uneven and patchy this evidence

is: Of the 37 reading parameters examined in this series of experiments¹ only five show convincing evidence of the need to mark tone fully. In Table 1, p values are indicated in parentheses, with those that are statistically significant at the <.05 level highlighted in gray.

Table 1. Focal languages demonstrating statistically significant improvement on full tone texts

| | Natani | Ife | Mbelime | Idaasha | Eastern Dan |
|---------------------------|---------------------------------|---------------------------------|---------------------------------|------------------|----------------|
| Speed increase | 12.37% (0.078) | 13.99% (0.060) | – | – | – |
| General accuracy increase | 26.09% (0.073) | – | – | – | 18.95% (0.094) |
| Tonal accuracy increase | 51.15% (0.001) | 58.14% (0.001) | 43.46% (0.090) | – | – |
| Comprehension increase | 13.82% (0.005) | 12.07% (0.018) | 13.90% (0.036) | 8.34% (0.081) | – |

The gains and losses analyses echo this pattern. In Table 2, it should be remembered that the underlying scales of the speed and comprehension variables (on the one hand), and the two accuracy variables (on the other), run in opposite directions. That is why, for speed and comprehension, we report languages in which a majority of participants improved when reading full tone texts (i.e. group level gains), and for the two accuracy measurements, we report languages in which a majority of participants scored more errors when reading zero tone texts (i.e. group level loss of accuracy). Natani and Ife are the only focal languages which register scores of over 50% on all four measures.

Table 2. Focal languages in which majority of participants improved on full tone texts

| | Natani | Ife | Mbelime | Eastern Dan |
|------------------|--------|-----|---------|-------------|
| Speed | 64% | 61% | 55% | – |
| General accuracy | 60% | 69% | – | 66% |
| Tonal accuracy | 70% | 60% | 62% | 74% |
| Comprehension | 63% | 59% | – | – |

1. I.e. 10 languages x L1 SPEED, 10 languages x L1 GENERAL ERRORS, 10 languages x L1 TONAL ERRORS, 7 languages x L1 COMPREHENSION.

Ife, Nateni and Mbelime are also the three languages with the most proficient tone writing skills and Ife was the only language in which a majority of participants scored over 90% in the writing task (Table 3).

Table 3. Focal languages with highest tone writing scores

| | Ife | Nateni | Mbelime |
|-----------------------------|--------|--------|---------|
| Mean writing success | 81.91% | 78.43% | 68.69% |
| Majority scored 90% or over | 58.06% | – | – |

On the other hand, we have no evidence that full tone marking contributes to the other measured skills in the above languages, or to any measures at all in Yoruba, Tem, Elip, Mmala or Yangben. And even in the languages where performance on full tone texts shows statistically significant improvement over zero tone performance, it must be said, the size of the contribution is not as impressive as proponents of full tone marking might hope for.

2.2 The ten focal languages: A summary of findings

2.2.1 *Tem*

Tem has a relatively large population, tacit government backing of language development, and limited use as a trade language in the north of Togo. Motivation for L1 literacy is relatively high, and literacy work was being well funded by international donors in the years running up to the experiment. The Tem tone system is generally well understood: it has two tones, automatic downstep and pervasive H tone spread. The Tem orthography, first standardized in the 1980s, has the lowest diacritic density and the longest average word length of all the focal languages, yet writers often choose to write without tone marks.

The Tem participants self-assessed as having the highest levels of L1 reading and writing frequency of any of the focal languages. The age range was among the widest, and they had the second highest average education level, after Yoruba. Tem was one of the languages in which everyone attempted the L2 reading task, but their mean L2 speed was no higher than the group average, and unmatched by accuracy (only Ife and Mbelime scored more errors). Nevertheless, they understood the L2 text better than any other language group.

The Tem read their L1 faster than any other group except Yoruba. They also make fewer general and tonal oral reading errors than any other group, and understand the L1 texts best. However, the presence or absence of tone marking offers no clear advantage on any of these measures. The Tem have unremarkable average scores on the writing task, and a wide range of proficiency.

As we reported in an oral presentation to the Tem literate community (Roberts, 2020e), a strong case can be made for abandoning full tone marking since it pays no dividends at all in terms of reading fluency and comprehension. Furthermore, the picture that emerged from a subsequent three-week participatory workshop is that the functional load of tone in Tem is weighted towards tonal inflection in the verb system (Weathers, 2020). We therefore encouraged orthography stakeholders to investigate the possibility of a partial tone marking system targeting only verbs.

2.2.2 *Nateni*

The written form of Nateni was first developed in the 1980s and the language has since benefited from two small literacy programs and modest literature output. It is a comparatively well-described language, and although no research specifically focuses on the tone system, we do know that Nateni is an almost entirely stable three tone language and that tone plays a prominent role in verbal inflection. Contour tones on single tone bearing units are written as long vowels in spite of the language also having contrastive vowel length.

Nateni has a comparatively small population, but had the second largest sample size (after Eastern Dan), so we can be relatively sure that the results are robust. Written Nateni is reported as having the lowest status (along with the three Bantu languages), while the status of formal education is also the lowest among the focal languages. It is therefore unsurprising that individual Nateni participants had, on average, been to school for the fewest years, and this, in turn, is reflected in the low levels of participation in the L2 oral reading task. Although mean L2 oral reading speed was among the slowest (second only to Mbelime), Nateni participants read more accurately and with higher comprehension than participants from some other language groups who read faster.

While the research question formulated at the outset did not require us to find a “winner”, we can still acknowledge that Nateni is the only focal language offering evidence of the value of full tone marking across all four oral reading measures: it definitely improves tonal oral reading accuracy (along with Ife and perhaps Mbelime) and comprehension (along with Ife, Mbelime and perhaps Idaasha). Full tone marking may also contribute to L1 oral reading speed and L1 general accuracy. Nateni is one of only two focal languages (along with Ife) which scores over 50% on all four measures of the gains and losses analysis. As for the writing task, the average success rate is the second highest of all the focal languages (after Ife), though an average of 78% leaves plenty of room for improvement and the range of scores was very wide.

We should also add that Nateni was the only focal language in which we met some local resistance to the testing. The Nateni Bible translators and literacy workers are convinced of the necessity of fully marking tone and it was only with a

certain reluctance that the principal Bible translator accepted the need to run an experiment at all. Perhaps the results support his intuitions. In an oral report presented to Nateni orthography stakeholders, we encouraged them to continue with the current system of full tone marking (Roberts, 2020d).

2.2.3 *Mbelime*

Mbelime, like Nateni, has a comparatively small population with a modest literacy program and literature output. The tone system has been thoroughly analyzed. With its three tones, downstep, upstep, and numerous tonal processes, it is arguably the most complex of all the focal languages.

The Mbelime orthography was first developed in the 1980s, though full tone marking was only introduced in 1999. This is the version of the orthography that was tested in our experiment. It under-represents contour tones and inconsistently writes downstepped H as M. It does not represent post-lexical upstep. At the time the experiment was run, it was the only three-tone focal language (and indeed the only Beninese language) to mark M with a macron and L with absence of an accent.

The Mbelime experiment had the fewest female participants of all the focal languages. However, this is by no means representative of the ethno-literacy profile of the language; on the contrary, women tend to be more motivated for L1 literacy than men (Bernard Sanhouégoua, p. c.). Mbelime reported the second highest number of dialects (after Eastern Dan) and the lowest number of participants speaking the reference dialect. The Mbelime group had one of the lowest average levels of formal education, and one of the lowest participation levels in the L2 reading task (along with Ife and Nateni in both cases). This is doubtless why the Mbelime participants had the slowest L2 oral reading speed and a high level of L2 oral reading errors. Given these poor results, it is rather surprising that they had the second highest level of L2 comprehension (after Tem).

As for the L1 results, we find scant evidence in Mbelime that full tone marking, or its absence, contributes to reading speed or general reading errors. Tone marking may contribute to reducing the number of tonal reading errors, but the evidence is less clear than it is in Nateni and Ife. Full tone marking also increases L1 comprehension, and here the difference between the two experimental conditions was the widest of all the languages assessed. In the gains and losses analyses, Mbelime registers small majorities on speed and tonal accuracy. Mbelime has the third highest level of tone writing accuracy (after Nateni and Ife), though their average success rate is not spectacular. Only two participants manage to write tones with more than 90% success rate. Furthermore, scorers often find it difficult to assess whether a hand-written tone diacritic was supposed to be M tone (horizontal) or H tone (slanted).

Mbelime is one of the languages that has benefited from further research on tone orthography since the 2015 experiment. An analysis of written ambiguity levels in the unmarked versions of the four experimental texts shows the load to be spread between the lexicon and the grammar, but weighted towards the grammar. It also assesses the level of written ambiguity to be lower than Elip and much lower than Eastern Dan (Roberts, Boyd, Merz, & Vydrin, 2020).

Mbelime is also one of two languages (along with Eastern Dan) in which our experiment has already contributed to spelling reform. Following a three-week participatory workshop (Olson, 2020), decision makers chose to switch the tone marks marking L tone with a grave accent instead of M with a macron, to bring them in line with Beninese government recommendations (CNLM, 2017). However, this reform was more influenced by the social process of running the experiment than the impact of the scientific results of it, since our experiment did not test the choice of symbolization. In an oral report presented to Mbelime literacy stakeholders, we recommended that decision makers continue with full tone marking, and endorsed the symbolization reform (Roberts, 2020c).

2.2.4 *Eastern Dan*

Eastern Dan has the second largest population among the focal languages (after Yoruba), and its tone system – which is among the best described – is quite exceptional, being the only one of the focal languages with five phonemic level tones and multiple contours. It is also the only focal language that is the sole representative of its linguistic family (Mande), although it makes up for this by being by far the largest language sample. The orthography has the second highest overall diacritic density (after Yoruba) and the shortest average word length of any of the focal languages. In addition, it is the only orthography that, at the time of the experiment, was employing word-initial and -final punctuation symbols in place of the more usual superscript diacritics to mark tone; this system led to under-representation of tone on polysyllabic words.

The Eastern Dan sample also has a highly atypical demographic profile. It had the oldest average age, the highest percentage of participants with two parents who are L1 speakers, the highest percentage of those reporting poor eyesight, the highest number of dialect variants – although the sample represents only a third of the total number – and the lowest self-assessed L1 writing frequency. The language community as a whole reported the lowest levels of tertiary education (along with Ife).

The Eastern Dan group does not fare well on the L2 reading task. They have one of the slower mean L2 reading speed scores (better only than Nateni and Mbelime), the lowest mean L2 comprehension rate, and the lowest proportion of participants who answered all the comprehension questions correctly.

Their poor L2 skills find an echo in their L1 skills. Irrespective of whether tone was marked, Eastern Dan participants have the second slowest L1 reading speed (only Yangben was slower), one of the higher general oral reading error rates (again, second only to Yangben), by far the highest tonal error rate and the lowest L1 comprehension scores.

We find cautious evidence that the presence of full tone marking may be helpful for reducing general oral reading error rates in Eastern Dan. More encouragingly, the gains and losses analysis does provide credible proof that zero tone marking inhibits accuracy, and in particular tonal accuracy. In contrast, full tone marking contributed less to comprehension than in any other language, to the point of being negligible. Eastern Dan mean comprehension scores were higher on the L1 text with no tone marks than on the L2 text.

As for tone writing skills, the Eastern Dan results do stand out as being higher than one might expect given the high oral reading tonal error rate on tone marked texts. But they are by no means spectacular: the average was 61%, and fewer than 4% of participants scored over 90%.

All this begs the question: Why are Eastern Dan L1 literacy skills so poor? Is it because the tonal inventory of the language is so much richer than that of any of the other focal languages? Is it because of the distinctive symbolization of tone that was being used at the time of the experiment? Is it because the monosyllabic nature of the language leads to high degrees of homophony, even when tone is marked? Is it because of the pedagogical approach chosen for the instructional materials? This last possibility seems unlikely because, while it is true that the Eastern Dan literacy primer contains no designated tone lessons, no other literacy program places such a strong emphasis on tone: trainee teachers are taught, from the very beginning, to give tone marks equal consideration along with consonants and vowels.

However, it would be wrong to conclude that the poor Eastern Dan results are caused by the highly atypical language and orthography profiles; social factors appear to be far more important. In particular, the Eastern Dan literacy program was decimated by two civil wars, from 2002 to 2007 and in 2010, and activities were in spiral decline right up to the eve of the 2015 experiment. So it is likely that many of the Eastern Dan participants had more or less lost their reading and writing skills and for some, it was probably the first L1 reading experience they had had for many years. This, in turn, raises the question (and may provide some evidence) of how long it takes to lose previously acquired literacy skills (cf. Akpakla, 1992). Some might argue that if the whole purpose of any training regime is to move those enrolled beyond the need to attend classes, the rupture in the literacy program should not have had an impact on those who have already graduated. Unfortunately, much of the published literature, which autonomous readers depended on to nourish and improve their skills, was destroyed during the wars.

Eastern Dan is the language in which we have had the opportunity to undertake the most supplementary research since the 2015 experiment, and this has resulted in three additional studies. Firstly, a qualitative analysis identified potential sources of tonal errors in the Eastern Dan texts (Roberts & Vydrin, 2019). Secondly, a linguistic analysis of the four texts shows levels of written ambiguity to be extremely high in both the lexicon and the grammar, far higher than in Elip and Mbelime (Roberts et al., 2020) and, almost certainly, although we have not substantiated the claim, than in any of the other focal languages.

Thirdly, in 2017 we ran a second quantitative classroom experiment to test a radical spelling reform proposed by Valentin Vydrin that advocated superscript diacritics for marking tone, biunique segmental correspondence and special characters for marking several vowels. Sixty-eight participants with no previous exposure to the written language were taught various combinations of tones and segments in four parallel groups and their acquired skills were tested in dictation and oral reading tasks. The results point to an advantage for the experimental orthography that maintains the existing tone marking strategy but embraces the proposed segmental changes (Roberts et al., 2019). In spite of this, Eastern Dan orthography stakeholders have recently adopted the proposed spelling reform in its entirety (Vydrin et al., 2019).

2.2.5 *Yoruba*

Yoruba is exceptional among the focal languages from a social and historical point of view. It has been written for far longer and the orthography has far more prestige than any of the other focal languages. It has the most extensive literacy programs in terms of size, scope and intensity, the highest levels of vision, leadership and resources for ongoing language development, and by far the most wide-ranging literature. Yoruba is used in schools, both as a subject and as language of instruction; it is the only language with official status, and is assessed as having the least chance of becoming endangered. Formal education has the highest status in the language community (along with Elip), and this is reflected in the highest levels of secondary and tertiary enrolment, which is unsurprising given that the sample was urban. Yoruba has by far the largest population, with over 20 million more speakers than the next largest (Eastern Dan). It is also by far the best described of the focal languages, and is the only one that has previously been the subject of tone orthography experimentation (Fagbørun, 1989; Klem, 1982).

The Yoruba sample was also exceptional on seven of the thirteen demographic measures. It had the highest proportion of females, by far the youngest average age, and among the fewest participants with poor eyesight. They were the only participants who were all living in the diaspora when the experiment took place,

and had, on average, spent by far the longest time outside of the language homeland. It was the only experiment that was conducted beyond the homeland, and, for this reason, the Yoruba were the only participants for whom we did not attempt to establish individual dialect profiles. The Yoruba sample also reported the highest level of formal education, and the most L1 literacy experience. Furthermore, the Yoruba experiment was the only one to take place in an Anglophone country, and therefore was the only one in which the L2 text was administered in English rather than French.

Yoruba is a three tone language with various tonal processes. The functional load of tone is comparatively heavy, and weighted towards the lexicon rather than the grammar. The Yoruba orthography has one of the highest tone diacritic densities (along with Ife and Idaasha) and the highest overall diacritic density among the focal languages. The tone orthography is consistent and transparent, representing isolated word forms.

Yoruba was one of five languages in which everyone attempted the L2 oral reading task. They emerge with the fastest speed of all, but unfortunately this skill does not necessarily ensure comprehension. Only about one in five Yoruba participants answered all the questions correctly, and they have the second lowest average L2 comprehension rate of all the languages tested (only narrowly beating Eastern Dan).

The Yoruba readers' L1 reading speed matches their L2 performance on the same measure, again outstripping that of all the other focal languages. Indeed, Yoruba is the only language in which L1 reading speed is faster than the ten-language L2 average, irrespective of whether tone is marked, though reading speed in neither condition outperforms the Yoruba L2 average. Only a minority of Yoruba participants read the full tone texts faster than the zero tone texts; for most, tone marking is either detrimental or made no difference.

The Yoruba participants make comparatively few general reading errors when reading their L1, and, again, we find no evidence that tone marking impacts these results. A larger percentage of participants score more general errors on the full tone texts than on the zero tone texts, and for most participants their general error rate is uninfluenced by the presence or absence of tone marks.

The Yoruba make very few specifically tonal errors, and for most participants the presence or absence of tone marks makes no difference to their score, so our data do not corroborate Klem's (1982, p. 24) finding that full tone marking in Yoruba contributes to oral reading accuracy.

The Yoruba understand their own written language better than they understand written English, and it is the language with the biggest gap between L1 and L2 comprehension. But we find no clear evidence that full tone marking helps or hinders their L1 comprehension.

As for the writing task, eleven Yoruba participants – typically females with less L1 literacy experience – did not even attempt it. Among those who did complete the task, there is no middle ground: for every participant who excels in writing tone, there are four who are completely at sea, in spite of making few tonal errors when they read. This corroborates Fagb̄orun's (1989, 83–84) finding that most Yoruba literates are unaware of the tone marking rules and do not consider them to be important.

The experimental results lead us to conclude that, although Yoruba readers are very attached to their orthography for historical and cultural reasons and the tone orthography is highly unlikely to be reformed, it actually contributes nothing whatsoever to reading fluency or comprehension, and it is not mastered in writing (Roberts & Harley, 2018). These findings, along with an intensive analysis identifying potential sources of tonal errors in the Yoruba texts, have been shared with interested parties locally (Harley & Oyeniyi, 2016, 2019).

2.2.6 *Idaasha*

Idaasha is very closely related to Yoruba – both varieties have three phonemic tones and similar segmental and tonal processes – but their ethno-literacy profiles are highly dissimilar. Idaasha was only written down for the first time in the 1980s, literacy initiatives are modest in size, and comparatively little literature exists. Idaasha is also less well described and no study specifically focuses on tone.

Idaasha has the highest tone diacritic density of any of the focal languages, although only slightly higher than its close relatives Yoruba and Ife. It also has one of the shorter average word lengths (only Eastern Dan is shorter). The Idaasha sample had the widest age range and it was the only focal language that reported no dialectal variants.

The Idaasha sample had one of the higher mean levels of formal education, in third place after Yoruba and Tem. Unsurprisingly then, it was a language with a respectably high participation (80%) in the L2 oral reading task. They read with a relatively low mean error rate (second only to Elip), but comparatively slowly and their comprehension is among the weakest, shadowing the corresponding results in Yoruba.

As for the L1 results, they are the least clear of any of the focal languages. On all measures, they occupy the middle ground. We find no clear evidence that the presence or absence of tone marks helps or hinders L1 reading speed, general oral reading error rates, or tonal oral reading rates. The only results that may show marginal improvement on full tone texts are for comprehension. Idaasha has the second lowest mean L1 comprehension scores (only Eastern Dan scored less) irrespective of whether or not tone was marked. Idaasha writing ability is weak, with an average

of only 50% accuracy, which is higher than their Yoruba cousins but much lower than Ife. Idaasha also has a wide range of ability on this measure; six writers scored more than 90%, but 17 scored less than 50%.

On the question of whether Idaasha readers and writers need full tone marking, the jury is still out. In an oral report presented to Idaasha orthography stakeholders, we recommended continuing with the current system of full tone marking provisionally, but also organizing training in which tone is not marked to evaluate performance over a longer period (Roberts, 2020a).

2.2.7 *Ife*

Ife is very closely related to Yoruba and Idaasha – it has three phonemic tones, similar segmental and tonal processes, short word length and high tone diacritic density – but the Ife population’s ethno-literacy profile is quite distinct from their cousins in Nigeria and Benin. Motivation for L1 literacy is high, and the burgeoning literacy program benefited from generous international funding from 2006 up to the time of our experiment and beyond. In contrast, little published linguistic research exists, and no study specifically investigates the tone system.

The Ife language community reports having one of the highest levels of vision, leadership, and resources for ongoing language development, second only to Yoruba. The Ife sample had the lowest number of participants who had spent time out of the language homeland. It also had the second lowest level of formal education (not much higher than Nateni and considerably lower than Yoruba and Idaasha). Most Ife participants had only attended primary school, and six had never been to school at all; no Ife participants had tertiary education. Low education levels inevitably led to low levels of participation in the L2 reading task (again, only Nateni was lower). But here an unexpected twist emerged. Although Ife L2 oral reading performance was slower than for Yoruba and more error-strewn than for Yoruba and Idaasha, the comprehension of the few who felt able to do the L2 task was considerably higher than either of these language groups.

Turning to the L1 results, full tone marking contributes to a greater increase in Ife reading speed than in any other focal language, but the effect falls just short of being statistically significant. We find no clear evidence that full tone marking reduces Ife general oral reading rates, but it does significantly reduce tonal error rates, and this more so than in any other language (though Nateni comes a close second). Full tone marking also increases comprehension, although the effect is not quite as strong as it is for Nateni and Mbelime. Ife is one of only two focal languages (along with Nateni) which scores over 50% on all four measures of the gains and losses analysis. The Ife participants succeed in writing tone more accurately than do those of any other language. It was the only language in which a majority scored

over 90%, although the score range was wide and the average of 82% leaves room for improvement.

In an oral report presented to Ife orthography stakeholders (Roberts, 2020b), we recommended that orthography decision makers continue with the current system of full tone marking, but encouraged them to reconsider the current strategy for marking nasal vowels which results in diacritic stacking. One possibility would be to move the tilde to the subscript position, following Nateni and Mbelime.

2.2.8 *Elip, Mmala and Yangben*

All three Bantu languages have two tones with downstep and various tonal processes. All three orthographies under-represent non-automatic downstep and, in addition, Mmala under-represents contour tones on single orthographic TBUs. Average word length is comparatively long, exceeded only by Tem. The orthographies were developed more recently than any of the other focal languages so they have very little published literature. Motivation for literacy is generally very low, and the literacy programs suffer from weak organizational structures.

In all three languages, the L1 has the lowest reported status (along with Nateni), the shortest literacy history, and the highest levels of primary school enrolment (along with Yoruba). Yangben has the smallest L1 literacy program and the least vision, leadership and resources for ongoing language development. In Elip, L1 literacy activities have the most limited scope and intensity while formal education has the highest status (again, along with Yoruba). The Mmala and Yangben samples are also demographically exceptional on several counts. They are the two samples in which participants had the shortest previous L1 literacy experience (with Elip not far behind), and the lowest L1 reading frequency. In addition, Elip had the highest percentage of participants with at least one parent who was not an L1 speaker of the focal language.

In contrast, participants from these languages demonstrated quite proficient L2 reading skills. Yangben and Mmala literates have some of the higher L2 oral reading speeds, exceeded only by Yoruba. Elip participants, although slightly slower, read the L2 text with the fewest errors.

However, we detect little evidence of bilingual transfer. Participants in all three languages read the L1 texts, with or without tone marks, more slowly than they do the L2 text. Yangben has the slowest L1 reading speed of all the focal languages, and Elip scores poorly on this measure too. The Yangben participants also read the L1 texts with by far the highest general error rate.

Neither can we offer any evidence that the presence of full tone marking impacts speed or accuracy. Tonal oral reading error rates are extremely low irrespective of whether tone was marked. In all three languages, the largest group is

made up of those for whom marking or not marking tone made no, or very little, difference.

Elip and Yangben are the only languages in which all the participants completed the writing task, but perseverance is not matched by competence: tone writing accuracy scores being by far the lowest of all the focal languages. In these two languages, the majority of participants scored under 50% and no one scored over 90%.

We have had the opportunity to do further linguistic research in Elip since the 2015 experiment. In an analysis of the Elip texts, we found scarcely any lexical tone, but numerous cases of grammatical tone in verbal inflection. We assessed the level of written ambiguities if tone is not marked in Elip to be similar to Mbelime, but much lower than in Eastern Dan (Roberts et al., 2020).

To summarize, the experimental data from the three Bantu languages provide no proof at all that the current full tone marking strategy contributes to reading fluency or that literates have mastered writing tone. The final joint report prepared for these three languages concluded by advising that, given the importance of grammatical tone in these languages, orthography stakeholders would do well to investigate a partial tone marking strategy targeting only the verb phrase (Roberts & Boyd, 2018). Unfortunately, decision makers are veering in the opposite direction, to a surface-tone marking system at the cost of the consistent word images that promote reading fluency.

2.3 Impact of independent variables

To complete the picture, it will be helpful to summarize those independent variables that were found to have an impact on the various measures of reading and writing performance in the multilevel statistical analysis. In Table 4, the symbols “+” and “-” indicate positive and negative contributions, respectively. It should be borne in mind that a negative contribution to errors indicates a positive contribution to accuracy. Symbols in parenthesis indicate that they are no longer valid when the outlier language EASTERN DAN is excluded from the dataset.

If single-level modeling had been used, GENDER and EDUCATION would have been predictive at various points in the analysis but they are completely overshadowed once placed in a multilevel model. Similarly, WORD LENGTH would have appeared more frequently but is only retained once, and then with due caution, in the multilevel model. There is a reasonable chance that READING FREQUENCY and WRITING FREQUENCY might have made a more significant appearance in some of our models if the scale used to measure them had been truly continuous. As it is, the somewhat rough categorization of self-evaluated responses (p. 203, footnote 16)

Table 4. Independent variables contributing to reading and writing performance

| Level | Type | Variable | L1 SPEED | L1 GENERAL ERRORS | L1 TONAL ERRORS | L1 COMPRE- HENSION | L1 TONE WRITING |
|-------|--------------------|----------------------------|-------------|-------------------------|--------------------|-----------------------|--------------------|
| 1 | Demo- graphic | EDUCATION | + | | | | |
| | | L1 EXPERIENCE | + | - | | | + |
| | | L1 READING FREQUENCY | | - | | | + |
| | | AGE | | | - | | |
| 2 | Ethno- literacy | L1 LANGUAGE DEVELOPMENT | + | - | | | |
| | | EDUCATION STATUS | | | | | - |
| 2 | Linguistic | NUMBER OF TONES | | | (+) | | |
| | | WORD LENGTH | | | | (+) | |
| | | TONE DIACRITIC DENSITY | | | | (+) | |

probably weakened their impact. It is also worth drawing attention to those level 1 demographic variables which were never predictive of performance, such as DIASPORA, PARENTAGE and FIRST LANGUAGE.

What is remarkable in Table 4 is that it is dominated by level 1 variables describing the literacy profile of the participant and level 2 variables describing the ethno-literacy profile of the language community. Level 2 linguistic variables describing the linguistic profile of the language and its orthography only occur three times in the entire analysis, and they all fade out of focus when EASTERN DAN is excluded. The L1 COMPREHENSION analysis rejected an alternative model containing ethno-literacy variables (L1 LANGUAGE DEVELOPMENT and L1 LITERACY HISTORY), but only narrowly. A separate cluster analysis confirmed that linguistic variables are not in the forefront when it comes to explaining the patterns in the data (Roberts & Walter, 2019).

2.4 Interpretation and discussion

Although the experimental data make a convincing case for abandoning full tone marking in some of the languages (Tem, Yoruba, Elip, Mmala, Yangben), they cannot be used in unilateral defense of full tone marking in the others, partly because the evidence is so sparse, but also because we do not know whether, under different experimental conditions, partial marking would have produced

similar or improved results. It could be that the most fluent readers, faced with full tone marking, gradually learn to identify which of the multiple tone markings are truly useful, and take their cues from them, while filtering out those that they consider to be superfluous. Testing this possibility was beyond the scope of our experiment design.

The five languages that demonstrate statistically significant, or almost significant, effects in favor of full tone marking (Nateni, Ife, Mbelime, Idaasha and Eastern Dan) share two broad similarities: one linguistic and one demographic.

Linguistically, all of them have three or more tones (though the inverse is not true: Yoruba has three tones but shows no improvement on full tone texts; we will return to this important point below). As for the two-tone languages – Elip, Mmala, Yangben and Tem – they are left far behind, never coming close to delivering persuasive evidence in favor of full tone marking on any measure. From now on, if these four language communities choose to continue marking full tone, they can at least do so with their eyes open, maintaining it solely on the grounds of social acceptability, which is a valid criterion. One might even speculate whether full tone marking is ever appropriate for two-tone African languages. While avoiding the pitfall of extrapolating data from a handful of two-tone languages to hundreds of others, we advise anyone involved in developing an orthography for a two-tone African language to be wary of adopting full tone marking unless it can be shown experimentally (through quantitative classroom interventions), not just linguistically (through phonological analysis), that it is truly beneficial for learners. In any case, as the statistical analysis has shown, linguistic concerns are the least persuasive of any.

Demographically, four of the five languages in which we have some evidence of the value of full tone marking – Nateni, Ife, Mbelime, and Eastern Dan – are the very languages with the lowest levels of formal education, and therefore the lowest L2 reading speed. This suggests that full tone marking may be particularly beneficial for those with fewer years of schooling and who therefore have not mastered literacy in the official language. It may also suggest that those who are not literate in the L2 are more apt to accept that full tone marking is useful for their L1. We should also remember that those level 1 demographic variables that are related to L1 literacy, such as experience and reading frequency, are dependent on the level 2 ethno-literacy variables since it would be impossible for an individual to acquire L1 literacy skills without the language community developing an orthography and implementing a literacy program. So we predict that full tone marking, like any orthographic strategy, will be of greatest value in a favorable, supportive ethno-literacy context – Ife being a striking example (Reeder, 2017) – and of little value in the opposite case.

This leaves us with one unresolved issue. Ife emerges as one of the three languages in which the positive impact of full tone marking is clearest across all

measures. But why are the Ife results so strikingly different from those of Yoruba, when these two languages are so linguistically and orthographically similar? Surely two such closely related languages should perform in tandem?

To account for this divergence, we need to look at social issues. The Yoruba participants, with their high levels of education (which, uniquely among the focal languages, includes L1 literacy) and their wide and regular exposure to the written language, apparently have sufficiently well-honed L1 literacy skills to be able to read without full tone marking. The Ife, on the other hand, have much lower levels of formal education, and far less exposure to the written language. Full tone marking may be helpful for them at this stage in their literacy development (Roberts, Harley, & Walter, 2019).

This comparison between Yoruba and Ife is the clearest evidence we have that the demographic profile of the reader and the ethno-literacy profile of the language community are more important than the linguistic and orthographic profiles of the language in predicting the ability to encode and decode full tone marking (cf. Hanemann & McKay, 2019). In the same way as social issues almost always override linguistic ones in orthography decision making (Cahill, 2014), so they do when it comes to fluency of reading and writing full tone. This is one of the most critical findings of the experiment. Across all the languages, not just in the Ede family, the value of full tone marking is related to how well one can read. Less practiced readers, by whatever measure, benefit more from full tone marking while more experienced readers appear not to need it or to need it less.

3. Tone pedagogy

Among the many diverse challenges that bedevil those engaged in developing literacy materials for African languages, developing appropriate ways to teach tone is often relegated to the back burner. Perhaps this is not so surprising, given the professional gulf that exists between linguists and literacy specialists. Barriers need breaking down and dialogue nurtured. Few linguists are trained and experienced in tone analysis, and still fewer rise to the challenge of communicating their (often complex) research findings to literacy specialists. Some in this latter group may even display a certain reluctance to learn from scientific evidence beyond the domains of education and psychology. Yet even when they are convinced by the linguistic arguments, they then face the challenge of converting that knowledge into optimal pedagogical strategies. With this in mind, the following sections provide some pointers concerning the construction of literacy primers (Section 3.1) and transition guides (Section 3.2).

3.1 Literacy primers

It is much harder for learners to isolate tone from a word than it is to isolate consonants and vowels, perhaps because pronounced tone is always associated with a consonant or a vowel. Thus, pedagogical materials of an orthography that marks tone fully – if the language really needs this strategy at all – should spend at least as much time on raising awareness of tone and helping people to hear tone as on developing phonemic awareness and identifying letters. Two of the five languages that provide experimental evidence in favor of full tone marking – Nateni and Ife – are also those in which the published teaching materials place the strongest emphasis on learning tone. They introduce tone early, and provide ample opportunities for tone practice in both exercises and stories.

One of the more obvious pedagogical implications of current approaches to tone analysis is that, since it is the tone pattern rather than the individual tone that is the phoneme of tone, primers should systematically teach pairs of contrastive tone patterns (Snider, 2018, p. 98). In the same way as an experienced singer learns a song by focusing on the melodic phrases that make up the song, rather than on the individual notes and intervals that make up the melodic phrase, so those learning to read phrases in a tone language should be focusing on the tone patterns that make up the phrase, rather than on the individual tones that make up the tone pattern. Few of the primers among the focal languages fit this profile. Those that contain explicit drills to help people distinguish between tone patterns, such as *Idaasha* and *Ife*, do best in this regard, although they do not contain tone drills in every lesson. The *Eastern Dan* primer, which writes tone throughout its drills, albeit without explicit tone exercises, also provides sufficient reinforcement of tone teaching. Likewise, the *Nateni* primer writes tone throughout its drills but, unlike *Eastern Dan*, it does focus on tone patterns in the review lessons. However, it must be said that the *Nateni* primer would be strengthened if the contrast drills included tonal minimal pairs or triplets, as they do in *Eastern Dan*. The initial lessons in the *Elip*, *Mmala* and *Yangben* primers only contrast pairs of words. While the *Elip* and *Mmala* primers cover three patterns in their four tone lessons, and *Yangben*'s three tone lessons cover two patterns for disyllabic words and two for trisyllabic words, this does not cover the whole range of possible tone patterns. This is a long way from what Snider probably has in mind – rather like teaching only part of the alphabet.

Similarly, most of the focal language pedagogical materials do not have a deliberate focus on grammatical tone, in spite of the fact that the functional load of tone in most of these languages is weighted towards the grammar. A greater focus on grammatical tone would be desirable, but how should it be taught? For languages with grammatical tone, notably in languages with mobile tone, *Kutsch Lojenga*

(2014, p. 65) advocates giving special attention to the link between grammatical functions and forms. Yet only Elip among the focal language primers does this. This is a general weakness that needs to be addressed.

For some of these languages, accompanying teachers' guides contain additional classroom exercises. Reviewing these was beyond the scope of this book, but such exercises would partially compensate for any weaknesses in tone pedagogy. However, experience has shown that programs do not automatically supply their teachers with teachers' guides, nor do teachers necessarily use them even when available. Instead, they tend to rely on notes made during their training. Thus it becomes especially important to carefully construct the primer in order to ensure ample practice linking tone marks to sound. When languages have grammatical tone, these primers must ensure that all grammatical tone contrasts are explicitly taught and adequately practiced. Furthermore, teachers must be given explicit instruction and adequate practice during training workshops on how to teach tone. These two recommendations are necessary for both reading and writing, so that speakers may also become competent users of the written form of their language.

3.2 Transition guides

It is often assumed that Africans who are already literate in a European language can easily learn to read and write their own language. However, the need to develop tonal awareness is as important for this group of learners as for those just starting to learn to read and write. This can be difficult to do in a transition guide that may be used for self-teaching, as is the case with several of the focal languages in this book. While the keyword approach has been found to help both groups, other activities, such as the reading of nonsense sentences, are more useful for literates and semi-literates.

One of the primary distinctions between the pedagogical approaches advocated for literates and semi-literates on the one hand, and those for pre-literates on the other, is the need for activities that require, even compel, learners literate in a European language to focus on tone marks used in the orthography. However, this is impossible to control in self-teaching guides. The best the authors of this type of guide can do is encourage learners to read words aloud and listen to the tone patterns, generally giving them clues from L2 glosses. Several of the transition guides surveyed in this book do remind learners to pay attention to tone when reading and writing. The Yangben and Mbelime transition guides are the most consistent in this regard among those that may be used independently. The Eastern Dan transition guide is geared for the classroom and does an excellent job of teaching its exceptionally large tonal inventory, but it avoids polysyllabic words that would require the teaching of more complex tone patterns. The Nateni transition guide, which

appears to be for classroom use, does better in this regard. It encourages learners to memorize the sixteen tone patterns via keywords and to use them to determine how to write tones correctly in conjunction with quietly saying the word aloud, while also reminding them that they can always break the word into syllables to identify individual tones. However, this is contrary to Snider's (2018, p. 98) assertion that tone patterns are easier for native speakers to identify. It would be interesting to know which strategy has found the most favor with literate Nateni speakers.

Grammatical tone is another issue that is generally handled differently in transition guides than in literacy primers. Most of the guides examined in this book have at least one lesson where the significance of grammatical tone is emphasized; Mmala and Eastern Dan are the exceptions. This is particularly worrying in the case of Eastern Dan because it has multiple cases of grammatical tone. However, several of the guides only tell the students about the tone rules for pertinent particles and give examples; no exercises to reinforce the information are provided. The guides that do provide such reinforcement are Yangben, Idaasha, Nateni, Mbelime, and Tem.

Besides deciding whether the transition guide will be designed for classroom situations or for self-teaching, another major decision authors must make is whether to focus only on reading, or also on writing. Two of the transition guides examined in this book made the former choice: Tem and Ife. Both introduce the tone marks early in the guide, and provide a fair amount of reading practice. Ife, which is oriented for classroom use, includes a number of tone drills that make students focus on the tone marks and thus increase the odds that they are actually using that information as they read. However, literacy program coordinators and others in both languages testify that very few people ever learn to write the language well. If the use of the written language for self-expression and communication is to become a widespread cultural practice, then these programs may need to consider developing transition guides that teach writing as well as reading.

4. Methodological limitations and future prospects

This book began with the research question: *To what extent does full tone marking contribute to oral reading fluency, comprehension and writing accuracy, and does that contribution vary from language to language?* Our quest led us to conduct a series of quantitative classroom experiments, replicating and adapting the design that Bird (1999) developed for Dschang. The attentive reader will have realized by now that more is to be learned by exploring the question than by attempting a definitive answer to it. We have considered the implications of the experiment results for each of the focal languages in turn, but these must be weighed against any methodological limitations. Far from ending negatively, each of these represents a door pushed ajar

towards a possible vista for innovative future research. We will raise concerns about experiment design (Section 4.1), independent variables (Section 4.2), scoring procedures (Section 4.3), tonal processes (Section 4.4), comprehension (Section 4.5), orthographic inconsistency (Section 4.6), and dialect variants (Section 4.7).

4.1 Experiment design

Experiment design, especially in the humanities, is never perfect, and some residual concerns remain about our own. We have already noted (p. 219) that readers suddenly faced with toneless texts for the first time might find the experience visually destabilizing to the point of negatively affecting performance. This is an important point, because in Bird's (1999) design, on which ours was based, all the participants were faced with the unmarked texts first. If this experiment design is ever replicated again, researchers would do well to consider counterbalancing it to eliminate any ordering effect:

- Group 1: Texts 1 and 2 Zero Tone; texts 3 and 4 Full Tone;
- Group 2: Texts 3 and 4 Full Tone; texts 1 and 2 Zero Tone;
- Group 3: Texts 1 and 2 Full Tone; texts 3 and 4 Zero Tone;
- Group 4: Texts 3 and 4 Zero Tone; texts 1 and 2 Full Tone.

Furthermore, our series of experiments has only been able to provide a snapshot of literacy practice at a given point in time. To complement this approach, the field needs longitudinal experiments that investigate changes in performance over time when participants are given extended opportunities for regular, daily practice in reading texts with no tone marks.

4.2 Independent variables

We also need to acknowledge the extent to which our design does and does not account for the data. Even the most fully specified models we tested never account for more than 40% of the variance in individual performance. This means that other as yet unidentified variables account for the remaining variance in performance. At the level of the individual participant, these could be, among other things, variation in personal IQ, amount of L2 literacy experience, and the degree to which they live in a literate environment. At literacy program level, additional variables might include variations in quantity of funding, quality of management, quality of instruction, longevity, and social attitudes towards L1 literacy. Clearly, much more has yet to be learned about literacy achievement and skill development in the reading and writing of African tone languages.

We introduced the ethno-literacy variables in the wake of the experiments when we gradually became aware, during the statistical analysis, that the dramatic variation in performance between focal languages had little to do with their linguistic and orthographic profiles and much more to do with literacy issues. We strongly recommend that future researchers should take ethno-literacy variables into account and find imaginative ways to expand and refine our own list. An obvious candidate is the ready-made EGIDS measure of language vitality (Lewis & Simons, 2010) with which we introduced the focal languages (p. 13) but did not then exploit in the statistical analysis. With hindsight it would have been judicious to do so.

Similarly, the statistical analysis did not control for pedagogical variables, so any potential link between tone pedagogy and tone reading fluency has not yet been adequately explored or quantitatively demonstrated. Ideally, we would have set up variables tracking how each of the pedagogical materials present tone, how much time they allot for practice, how progress is assessed, whether participants learned using a primer or a transition guide, and if the latter, whether the learning took place in a classroom or individually. But such an approach is fraught with difficulties. It would have been challenging to gather accurate data from each participant specifying which pedagogical materials they had been exposed to, particularly in Yoruba where many textbooks are on the market. Most adults in any society would be hard pressed to identify the literacy textbooks they used as children. Also, in any one language, teaching materials and orthographies are revised over time, so just because two participants learned from the same book, it does not mean that they used the same version. Still more importantly, once in the classroom a yawning gap often opens up between the intended use of pedagogical materials and their actual use by teachers. Any future experimentation that finds imaginative ways of untangling these issues will make a valuable contribution to the domain.

4.3 Scoring procedures

We have some residual concerns about tone scoring procedures. None of the researchers are L1 speakers of the focal languages in which they ran the experiments and most had not undertaken primary linguistic research on the respective tone systems, so we were highly dependent on L1 scorers. We gave them all demanding training and supervised them closely, but we cannot rule out the possibility that one scorer may have been stricter, have less well-developed analytical skills, or be less sensitive to tone than another. The latter possibility may also differ from language to language. It is possible that those scoring languages with a heavier functional load of tone are naturally more tonally aware (and therefore score tonal errors more rigorously) than those scoring languages with a lighter functional load of tone.

For example, at one extreme, Eastern Dan texts are strewn with monosyllabic words, each forming a tight triangular bundle composed of a consonant, a vowel and a tone. This can only help when scoring oral reading errors because each bundle is pronounceable and recognizable in isolation. In addition, Eastern Dan has a stable tone system, so scorers were not faced with untangling any issues related to orthographic depth: tone is always written as it is pronounced. Field observations confirm that the Eastern Dan literacy supervisors are highly aware of tones, and treat them as being functionally equivalent to consonants and vowels. Hence, we can be almost certain that the Eastern Dan results were scored accurately.

At the other extreme, in a language with much lighter functional load of tone such as Tem, scorers are not used to artificially extracting individual orthographic TBUs from a polysyllabic word and assessing them individually. Tem also has a mobile tone system, so the scorer is faced with the task of teasing out the issues relating to orthographic depth that are inherent in the pervasive H tone spreading rule. A mobile tone system inevitably makes the scorer's job more difficult.

4.4 Tonal processes

Initially, we had high hopes of being able to include a “tonal processes” variable that would be expressed in terms of a percentage stability rate for each of the focal languages. But the languages vary enormously in terms of what has already been published on tone, and the development of such a variable would have required further tone analysis in some of them, which we were not in a position to do. We then toyed with a simpler, binary “stable vs mobile” variable (Kutsch Lojenga, 2014), but towards the end of the statistical analysis we kept coming across intriguing evidence of limited tonal processes in some of the languages that we had provisionally labeled as “stable”. For these reasons we reluctantly abandoned the attempt to include a tonal processes variable. Nevertheless, we recommend that future researchers should pursue this idea and that, in doing so, they would do well to distinguish clearly between the *orthographic tonal stability value* and the *phonological tonal stability value*.

The *orthographic tonal stability value* compares the behavior of individual tones in written isolation forms with corresponding context forms. Quantifying it, as Bird (1999, p. 101) has demonstrated for Dschang, although time-consuming, is a relatively straightforward matter of comparing written isolation and context forms, tone by tone, to assess “the probability that any syllable bearing that tone in the isolation form of any word also bears the same tone in phrasal context”.

The *phonological tonal stability value*, on the other hand, compares underlying spoken forms with surface spoken forms (Kutsch Lojenga, 2014; Snider, 2014). Developing an accurate tool for quantifying it would be enormously beneficial, but

is fraught with challenges. What counts as tonal mobility? Tone spread and shift seem like likely candidates, but what about replacement tones, polar tones and tonal dissimilation? How should floating tones and toneless morphemes be assessed? Should lexical and post-lexical processes be quantified separately? Finding adequate responses to these questions is hampered not just by their inherent complexity but also by the dearth of published tone research in most of the languages that such a measure would be useful for.

To drive home the point, we can illustrate the difference between *orthographic tonal stability value* and the *phonological tonal stability value* with reference to Tem. With its pervasive post-lexical H tone spreading process it is, in phonological terms, a relatively mobile tone system. Although the lack of published tone analyses prevents us from calculating its phonological tonal stability value precisely, we do know that it will be towards the low end of the continuum. The Tem orthography, on the other hand, systematically represents the output of the lexical phonology, excluding post-lexical H tone spreading from written representations. This results in consistent word images: written isolation and context forms always match, even though spoken isolation and context forms do not. Therefore, the Tem orthographic tonal stability value is 100%.

This leads us to establish the following hypothesis that has yet to be tested empirically:

The phonological and orthographic stability hypothesis (POSH) predicts that when a tone language has low phonological stability value (i.e. a mobile tone system) and high orthographic stability value (i.e. the tone marking system represents the output of the lexical phonology), it will be no more difficult to read and write than the orthography of a language with a high phonological stability value (i.e. a stable tone system), all other things being equal.

4.5 Comprehension

Since this is the first time an African tone orthography experiment has included a comprehension component, and since it did not succeed in generating a plausible statistical model predicting performance on this measure, let us take a moment to evaluate the experience and suggest areas for improvement. Question answering, our chosen task, is probably the most commonly employed strategy for measuring comprehension and is relatively straightforward to prepare, administer and score. However, a reader may have fully understood the text but failed to understand the question, especially under the pressure of face to face interrogation (Hale et al., 2012, p. 540). Furthermore, Fuchs et al. (1988, pp. 20–21) note that question answering taps comprehension of only selected information that the researcher has judged to be important. This is a valid concern in our cross-cultural context

because researchers and participants may have different ideas about what constitutes importance.²

Our experiment design used three questions per text, which is clearly insufficient to evaluate comprehension of anything but the main points. We recommend that future experiments should contain more, and more detailed, comprehension questions, enquiring about implicit as well as explicit information (Piper et al., 2016, p. 142). Researchers might also consider scoring “partially correct” separately from “correct” and “incorrect” responses (Dowhower, 1987, p. 394), scoring the percentage of correct responses per minute (Freeland et al., 2000), having participants generate their own questions (Kamil, 2004, p. 224), testing retention over time (Kintsch & Van Dijk, 1978, p. 383), and using other response techniques such as retelling (Schimmel & Ness, 2017, p. 401), cloze (Fuchs et al., 1988), maze (Hale et al., 2012), and multiple choice tasks (Price et al., 2016, p. 179; Walczyk & Griffith-Ross, 2007, p. 564).

4.6 Orthographic inconsistency

Tone orthographies are often messy, and several of the ones represented in our experiment fall short of the linguistic ideal of total transparency. In Elip, Mmala and Yangben, “absence of an accent” means either L tone, or H tone on some class proclitics; non-automatic downstep of H tones is also under-represented, and Mmala under-represents contour tones on single orthographic TBUs. Nateni represents contour tones with long vowels even though vowel length is contrastive. At the time of the experiment, Mbelime was leaving L rather than M tone unmarked, contrary to the Beninese government’s recommendations. In the same language, downstepped H was being represented with an acute accent in a H or L environment, and by a macron in a M tone environment; contours on single orthographic TBUs remain underrepresented even following spelling reform. In Eastern Dan the punctuation symbols being used at the time of the experiment for L and xL were counter-intuitive, running contrary to Ivorian government recommendations, and some polysyllabic words were under-represented.

A certain level of orthographic inconsistency is probably inevitable and may do no harm if it is socially acceptable, but our concern here is that all the above mentioned strategies were adopted on the basis of linguistic and sociolinguistic arguments rather than on experimental evidence. Imaginatively designed classroom

2. Fuchs et al. (1988) go on to report an experiment assessing five comprehension measures. In fact, the question answering task does not emerge as the most effective measure, but the authors consider it to be useful so long as the set of questions is representative within a text and balanced between texts (p. 27).

experiments focusing on fine-tuned issues such as optimal strategies for representing non-automatic downstep and contour tones would contribute positively to the debate about the representation of tone in African orthographies.

4.7 Dialect variants

We took the time to form a dialect profile for each participant, and these data were fed into the statistical analysis as a demographic variable. But this jigsaw piece does not yet fit into the puzzle in any obvious way. More detailed investigation of the impact of dialect variants on reading and writing performance would have been desirable but impractical for several reasons. First, the numbers of participants representing each individual dialect within a given focal language was not large enough to produce statistical significance. And even if they had been, and we had found that one dialect performed with greater speed, accuracy or comprehension than another, we are not yet in a position to judge whether this is because the orthography more closely matches the tone system of that dialect than that of another. This is because description of dialectal tone alternations is nowhere in sight for any of these languages and is unlikely to become a research priority as long as so many other African languages are still waiting to be analyzed for the first time. The languages in which dialect studies would be most helpful are Eastern Dan, Mbelime and Yoruba, because they have the largest number of variants, and the tone systems of their reference dialects have already been adequately described.

5. Final remarks

In our preoccupation with the impact of full tone marking, we should not overlook the more general trend that literacy skills are poor across all measures. On average, the participants, all adults, orally read their L2 with a speed equivalent to what is expected of an American seven-year old, and their L1, whether tone is marked or not, with a speed considerably slower than what is expected of an American six-year old. Most participants are stuck on the bottom of the four rungs proposed by Zutell & Rasinski (1991), orally reading in a way that is “clearly labored and dysfluent (slow, word-by-word pauses, sound-outs, repetitions, lack of expression).” These worrying findings concur with those of our own previous experiments (Roberts et al., 2016, p. 133; Roberts & Walter, 2012, p. 244) and the wider literature on reading in Africa.

In these overwhelmingly oral societies, while a minority of skilled L1 readers in Africa attain standards of fluency equivalent to those in the developed world,

most literates are getting nowhere near sufficient exposure to print to become truly proficient, and this is a far more fundamental concern than any questions about how tone is marked.

Poor overall literacy skills notwithstanding, our series of experiments contributes a few shovelfuls more of empirical data to help bury any lingering notion that a single tone marking strategy can be applied to all African languages. In the face of these experimental results, only the most determined skeptic can continue arguing for a one-size-fits-all approach. In this series of experiments full tone marking was shown to be advantageous on only five of the 37 measures examined, suggesting that it should generally be considered an exceptional strategy, although it may have potential for beginners and those with poor existing literacy skills in a second language. Either way, full tone marking should only be adopted when both linguistic analysis and experimental data concur that it is beneficial. Tone analysis certainly has its place, but when it comes to developing orthographies, it only provides one angle; descriptive linguistics needs to be complemented by an experimental approach that furnishes empirical data from the classroom.

And there's the rub. Experimental linguistics is, in general, considerably more demanding than most forms of descriptive linguistics. It is much easier to beaver away in a quiet corner eliciting tone data with a single informant than it is to assemble the large numbers of participants needed for a busy classroom experiment. Experiments are also more expensive, as remuneration of some type is usually the only way to ensure adult participation. They are challenging to design, prone to logistical upset, and require extensive collaboration. The good news, on the other hand, is that cognitive psychologists investigating the reading process are keen to collaborate with linguists working on less well-known minority languages. And, with the experience many of them have in designing classroom experiments, they bring a wealth of expertise to the table and opportunity for fruitful collaboration.

Finally, we detect evidence of research fatigue at the highest levels of literacy advocacy. At international conferences focusing on Africa, it is not uncommon to hear the viewpoint: "We've had enough of classroom research, let's just get on with the job". Following such advice would cause literacy and education in Africa to drift into a nebulous post-truth era. One can only hope that the gradual accumulation of comparative research will eventually impact international training programs and field practice, so that in the mid- to long-term a more informed and mature view will emerge. If this book makes a small contribution to this process, it will have achieved its purpose. As far as tone orthography development is concerned, the best way forward is for researchers to assemble persuasive evidence from the classroom, in the hope that decision makers, in turn, will adopt evidence-based strategies.

Independent variables

1. Demographic variables (Level 1)

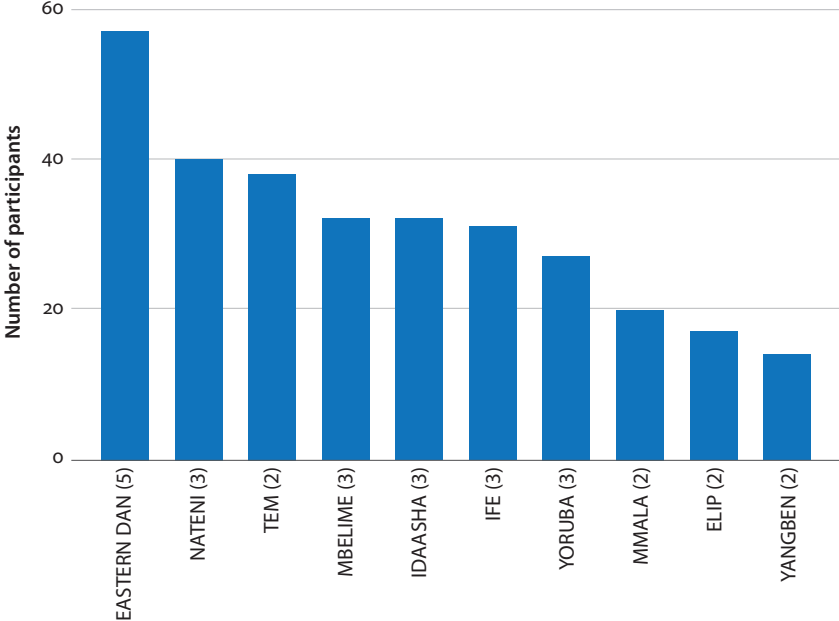


Figure 1. Number of participants by FOCAL LANGUAGE

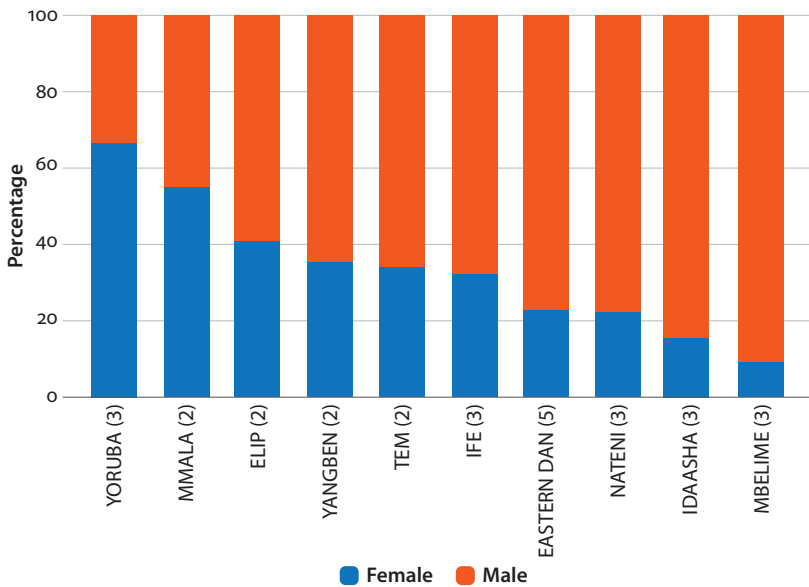


Figure 2. GENDER by FOCAL LANGUAGE

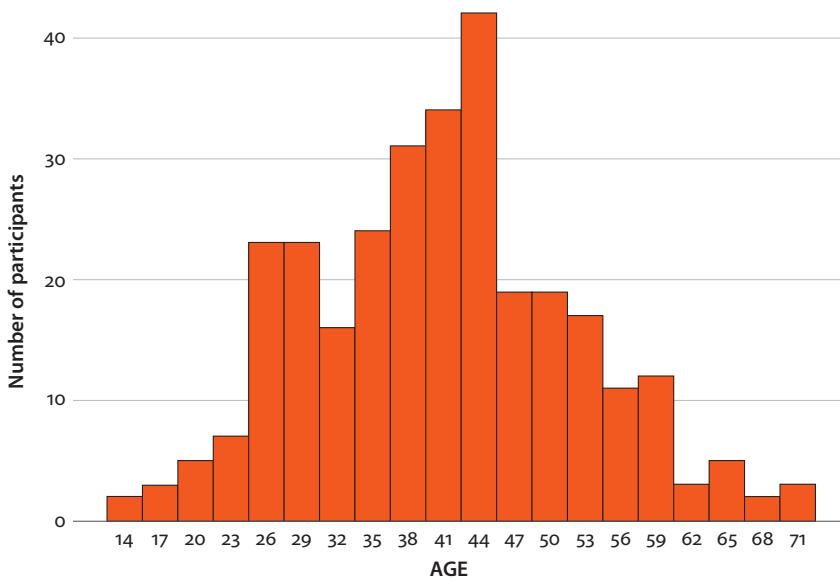


Figure 3. Histogram of AGE

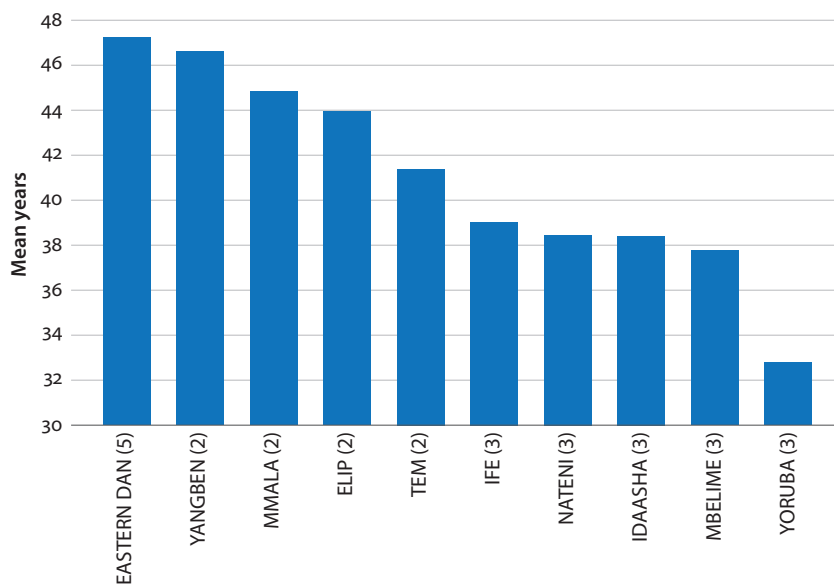


Figure 4. Mean AGE by FOCAL LANGUAGE

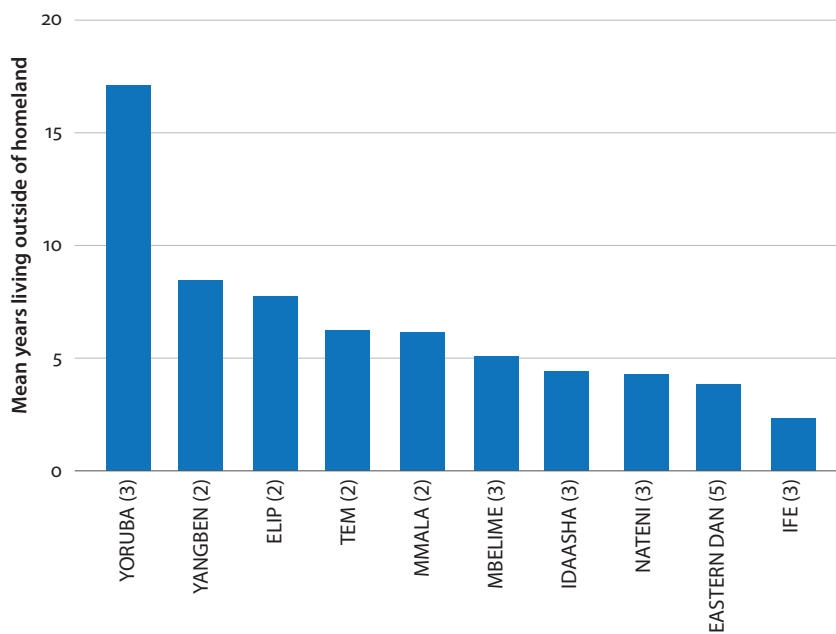


Figure 5. DIASPORA by FOCAL LANGUAGE

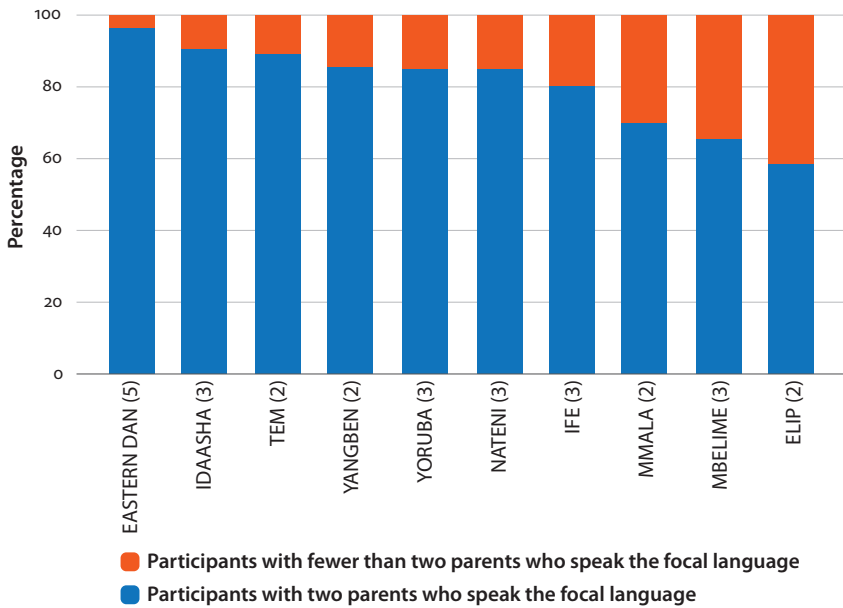


Figure 6. PARENTAGE BY FOCAL LANGUAGE

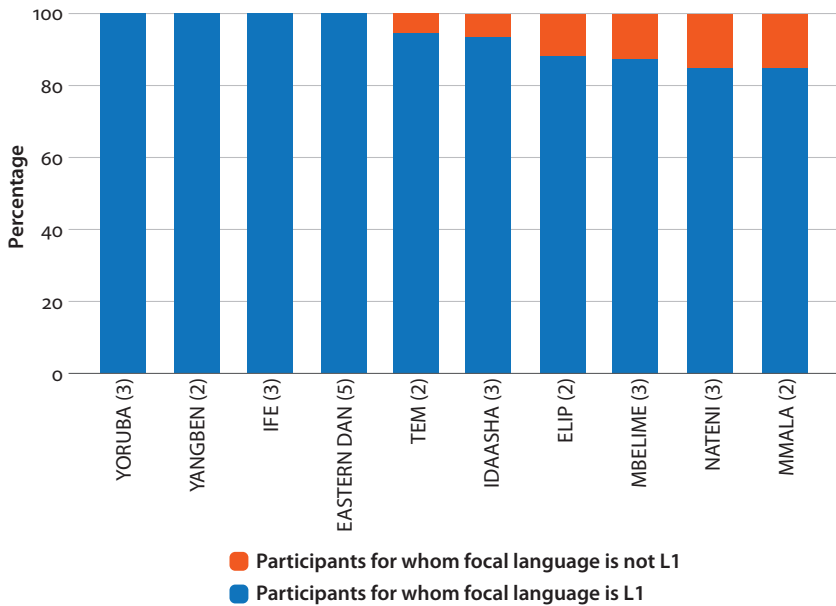


Figure 7. FIRST LANGUAGE BY FOCAL LANGUAGE

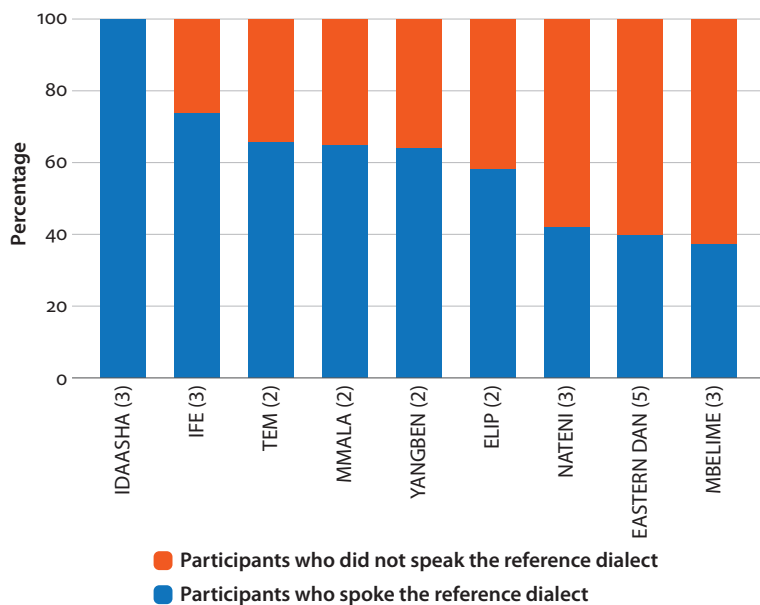


Figure 8. DIALECT by FOCAL LANGUAGE

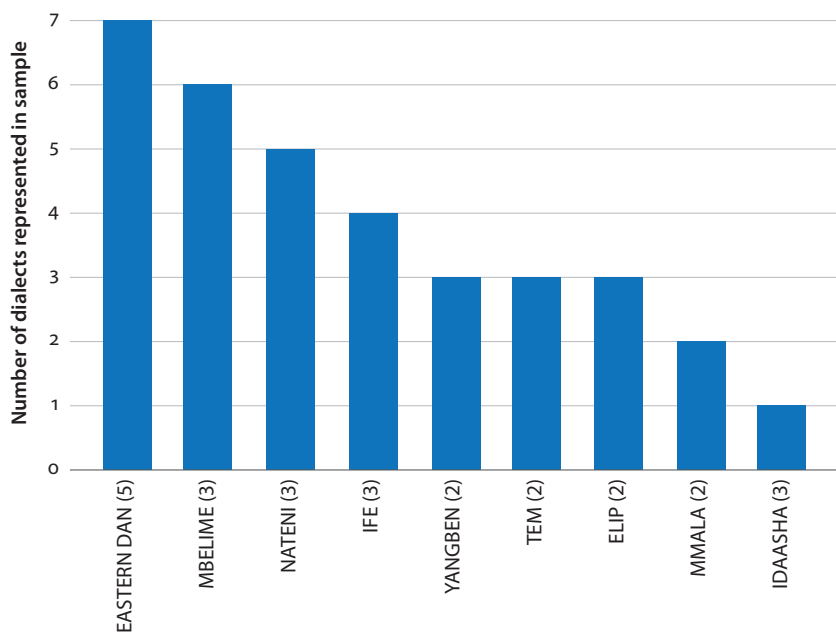


Figure 9. Number of DIALECT variants represented in the samples of each FOCAL LANGUAGE¹

1. We have no data about the number of dialects represented in the YORUBA group.

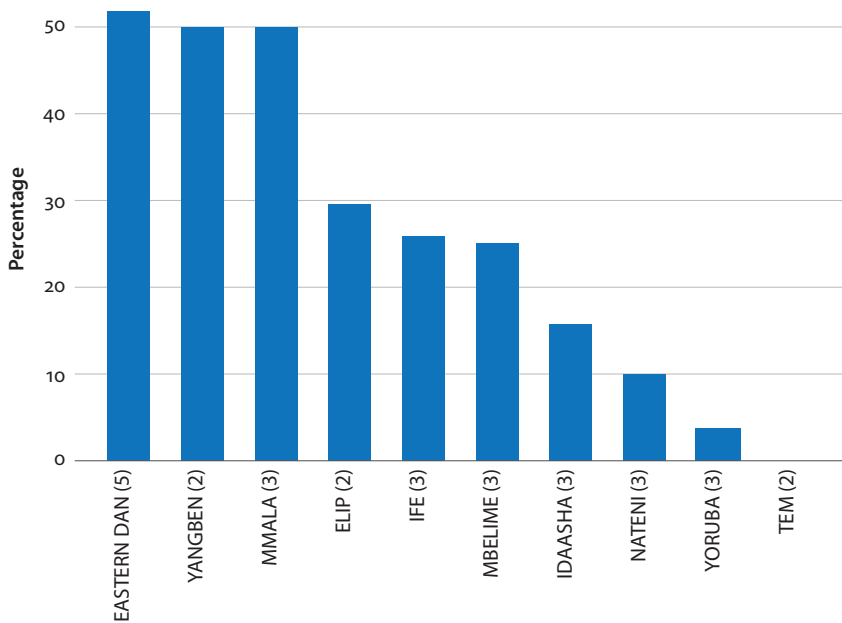


Figure 10. Percentage of participants claiming poor EYESIGHT by FOCAL LANGUAGE

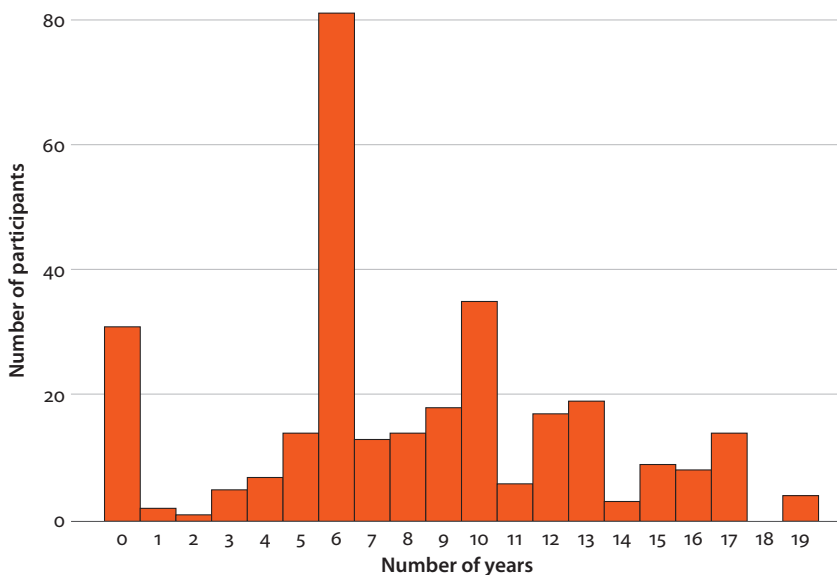


Figure 11. Histogram of EDUCATION

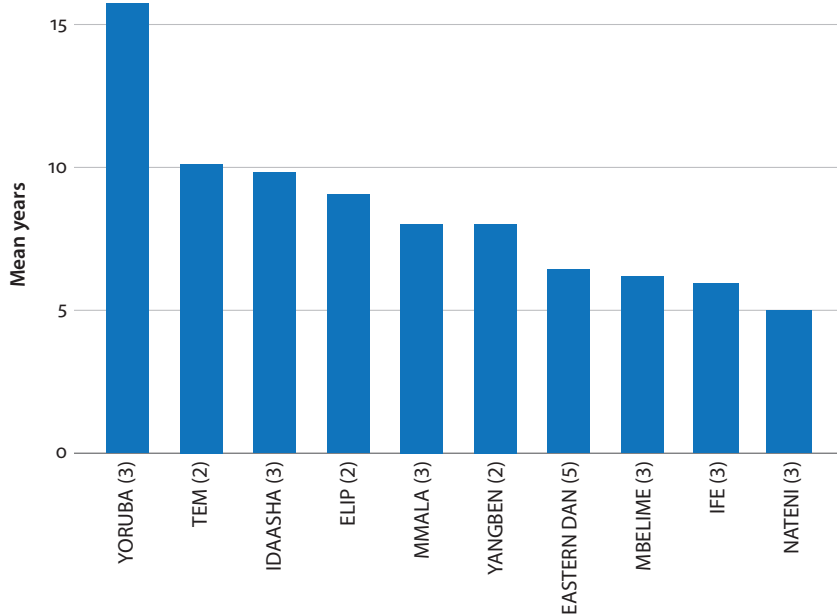


Figure 12. Mean years of EDUCATION by FOCAL LANGUAGE

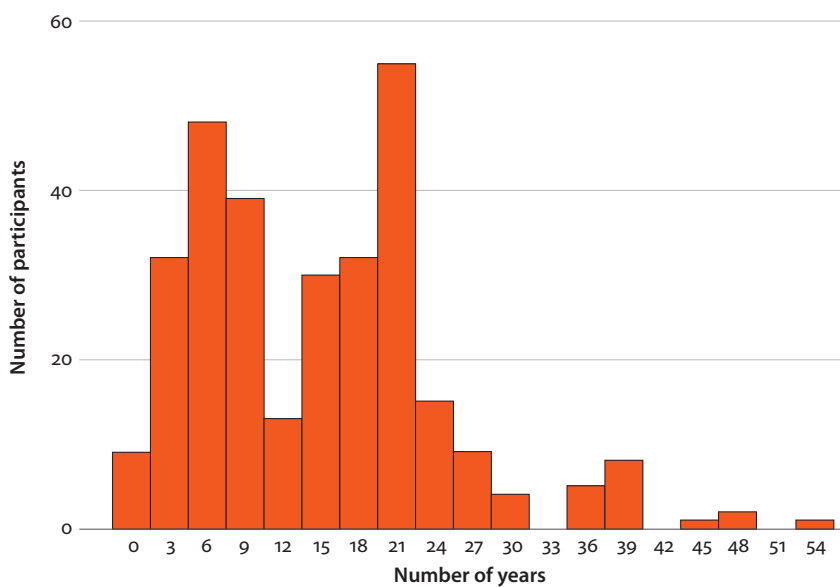


Figure 13. Histogram of L1 EXPERIENCE

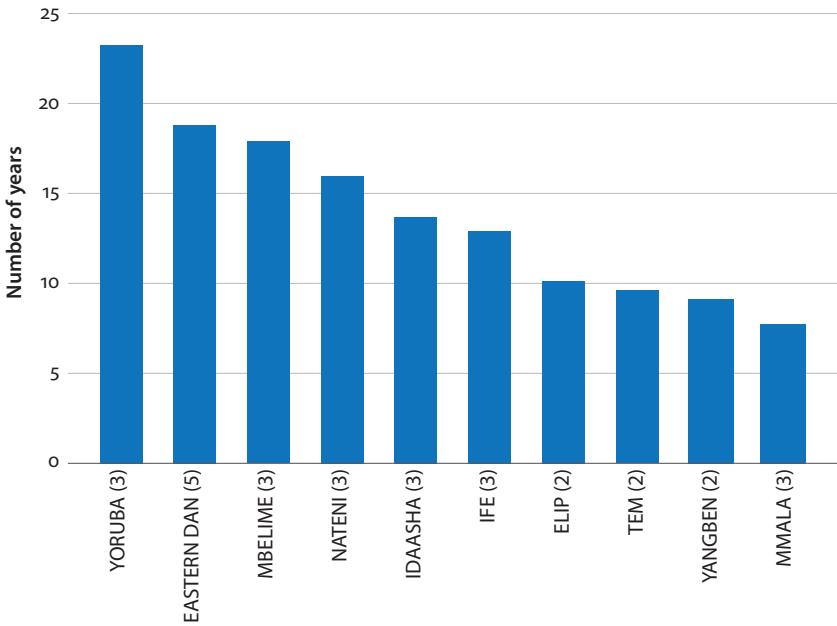


Figure 14. Mean years of L1 EXPERIENCE by FOCAL LANGUAGE

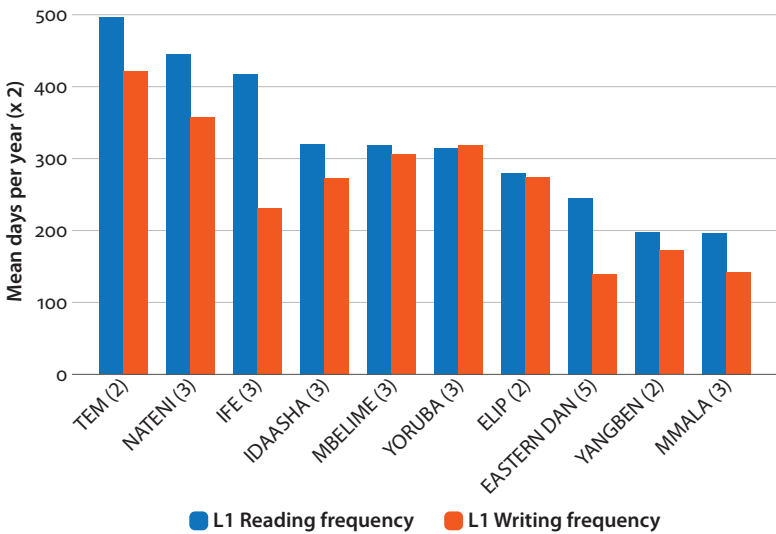


Figure 15. Mean L1 READING FREQUENCY and L1 WRITING FREQUENCY by FOCAL LANGUAGE

2. Ethno-literacy variables (Level 2)

2.1 L1 literacy history

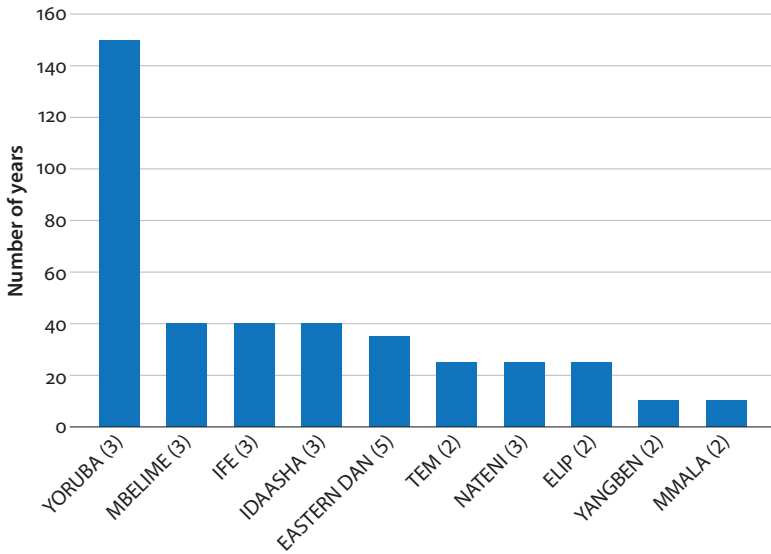


Figure 16. L1 LITERACY HISTORY by FOCAL LANGUAGE (number of years since the language was first developed)

1. Within the last 10 years
2. Within the last 25 years
3. Within the last 40 years
4. Within the last 60 years
5. Within the last 80 years
6. Within the last 100 years
7. More than 100 years ago²

2. In the case of YORUBA, we recorded the number of years more exactly.

2.2 L1 literacy program

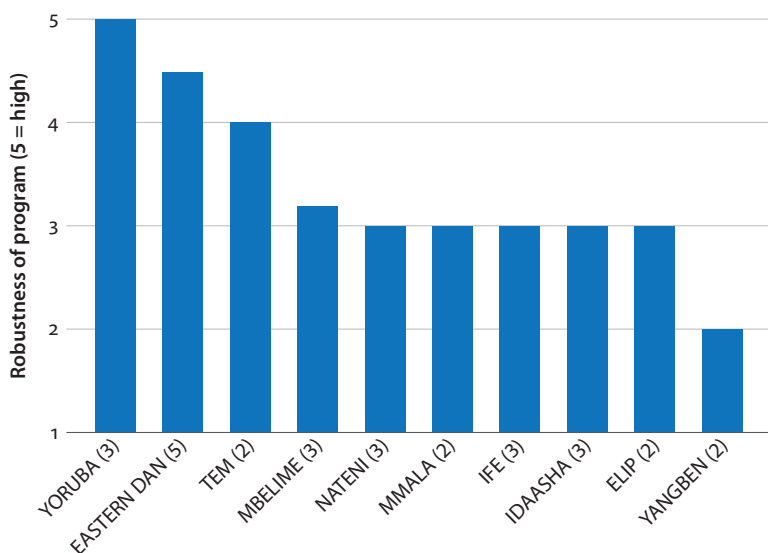


Figure 17. L1 LITERACY PROGRAM by FOCAL LANGUAGE

1. Just a few interested individuals were taught to read informally with only sporadic inputs since initial introduction.
2. A small-scale program was implemented with supporting materials and teacher training but this was not sustained for a long period of time (more than 10–15 years).
3. A small-scale program was implemented initially with supporting materials and teacher training which has become indigenized and continues at a fairly low level.
4. A small-scale program was implemented initially with supporting materials and teacher training. L1 literacy has been locally institutionalized and has benefited from vigorous local vision and interest.
5. A strong program was implemented at the beginning and this program continues vigorously with local leadership and strong local commitment to L1 literacy.

2.3 L1 literacy activity

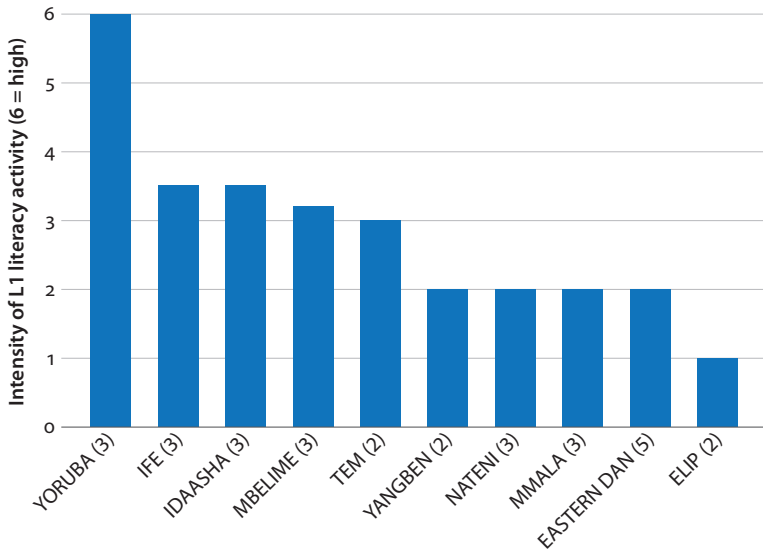


Figure 18. L1 LITERACY ACTIVITY by FOCAL LANGUAGE

1. There is only fragmentary interest and activity is mainly limited to certain individuals.
2. There are still occasional classes being organized and led by local teachers with a fair amount of general interest in L1 literacy.
3. There are regular classes in L1 literacy and substantial continuing interest.
4. Many speakers are now literate in L1 and one regularly sees activity requiring L1 literacy such as signs, letters, pamphlets, a few books, songs, and public information written in the L1.
5. L1 literacy is supported to some extent by local schools, governments, markets, religious institutions, etc. There are at least a few books in print and occasional new pieces of literature get printed. Messaging takes place in the L1.
6. L1 literacy is widely taught in schools and has become a normal feature of everyday life. Most people are literate in L1. Evidence of L1 literacy is widely available and speakers make use of literacy skills on a daily or very regular basis.

2.4 L1 language development

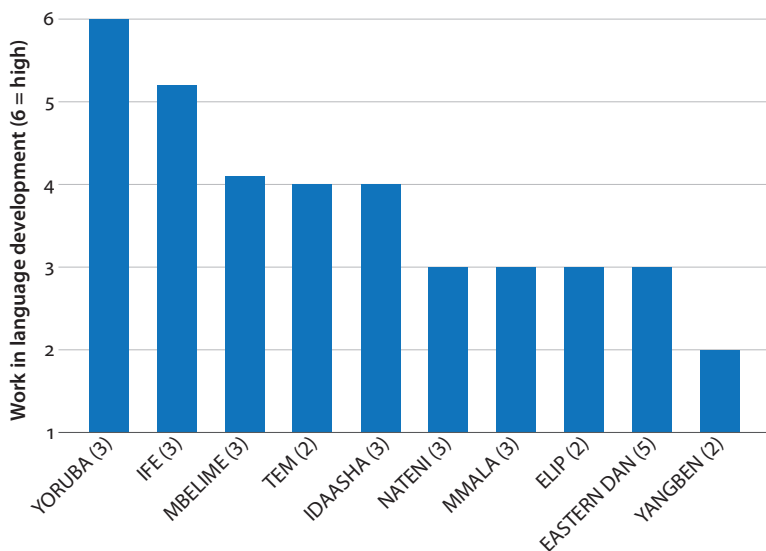


Figure 19. L1 LANGUAGE DEVELOPMENT by FOCAL LANGUAGE

1. There is no local vision or leadership for further work in L1 language development. The general perspective is that the language has little value beyond basic oral communication.
2. There are a few individuals who would like to see more work done in L1 language development but they struggle to mobilize enough local consensus, energy or resources to make this happen.
3. There is an organized local body devoted to L1 language development activity and this group is active but not highly effective.
4. Visionary local leaders and institutions are active in promoting L1 language development activity but these are not well resourced (neither financially nor in skilled personnel).
5. Visionary local leaders and institutions have been able to mobilize the resources needed to remain active in L1 language development work.
6. L1 language development has become sufficiently institutionalized that it has become a regular feature of life and work in the language community.

2.5 L1 language status

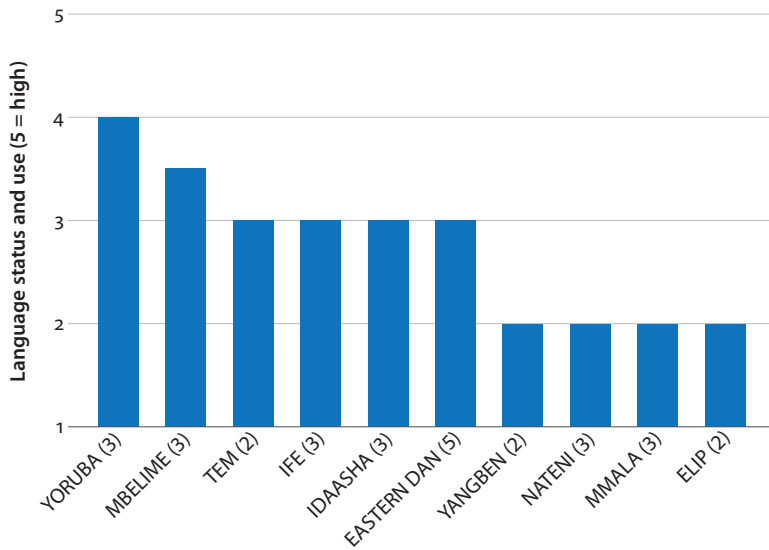


Figure 20. L1 LANGUAGE STATUS by FOCAL LANGUAGE

1. The language has no status other than appearing on lists of languages spoken in the country. It is still used in local contexts by the older generation but not so much by younger people and not much outside the homeland. It is typically not used outside of informal or family contexts.
2. The language has some recognition, at least at a regional level, and may be heard in markets and other less formal commercial activities. It is still spoken by young people.
3. The language is recognized as a regional language and is widely heard in the markets. It may also be used in local governmental functions and in churches. Speakers of other languages will learn some of the language. The language appears to be vigorous at the local level.
4. The language has official recognition though it is not called a national language. It is heard widely in markets, churches and various informal contexts. It is approved for use in local government activity. It may also appear in various local or national media such as radio, TV or newspapers.
5. The language is recognized as a national language and has reasonably high prestige. It is regularly used in most or all local institutions including schools. Many speakers of other local languages become bilingual in this language.³

3. Retrospectively, we detect a discrepancy in the values, as most authorities would agree that TEM has a higher status than MBELIME.

2.6 L1 orthography status

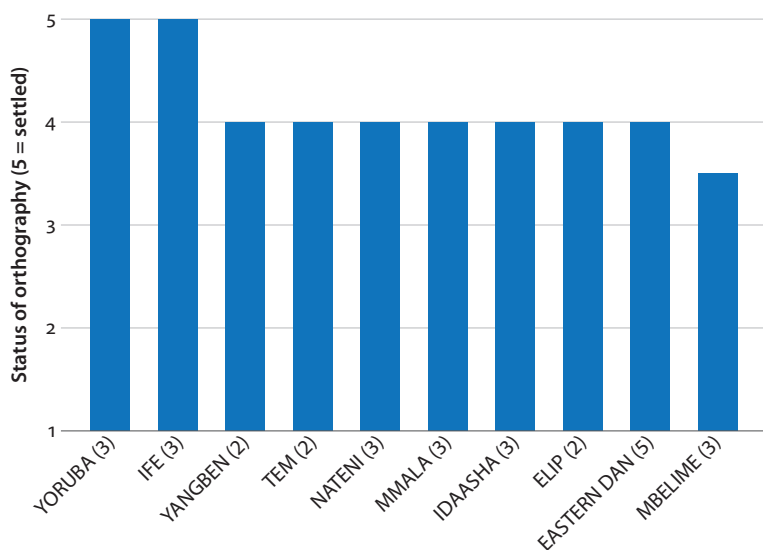


Figure 21. L1 ORTHOGRAPHY STATUS by FOCAL LANGUAGE

1. There is an orthography but it is still unofficial and not widely accepted.
2. There are multiple competing orthographies which create confusion and inertia in the development of L1 literacy.
3. There is an official and established orthography but it contains some problematic or unconventional elements which complicate normal literacy activity.
4. There is an official and established orthography which appears to be soundly designed. However, published pedagogical materials are somewhat deficient or difficult to use.
5. The language has a good orthography which is widely accepted and for which good pedagogical materials exist to teach literacy.

2.7 Education status

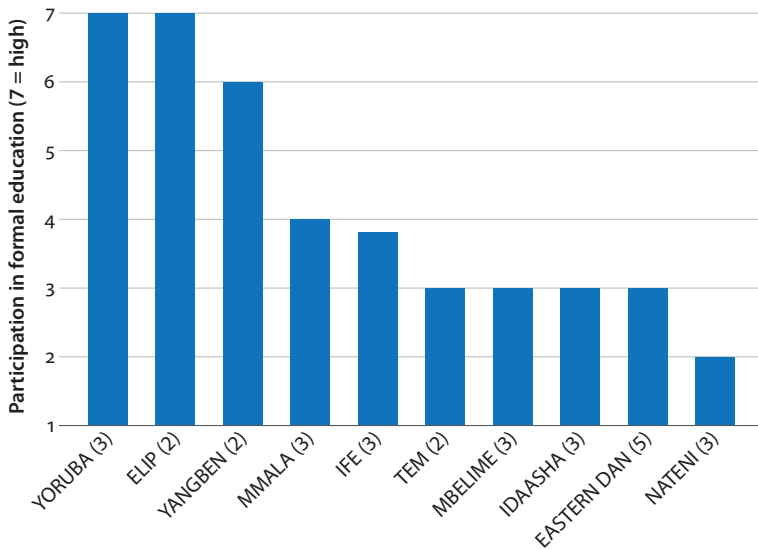


Figure 22. EDUCATION STATUS by FOCAL LANGUAGE

1. Primary education is not available to all in the community and a high percentage have never been to school at any level.
2. Primary education is now available to most children in the community but a high percentage of people over 40 did not complete at least six years of education.
3. The vast majority of children in the language area go to school but many do not complete primary education and a substantial number over 40 have no more than six years of education.
4. Most children in the area complete primary education and most over 40 did as well.
5. Most in the area finish primary and go on to secondary education; many over 40 have at least some secondary education as well.
6. Many in the area complete secondary education; some in the area over 40 completed secondary and have some tertiary education.
7. It is common in the area for children to finish secondary with a fair number going on to tertiary education; there are quite a few in the area who completed tertiary and a few have graduate degrees.

2.8 School enrollment

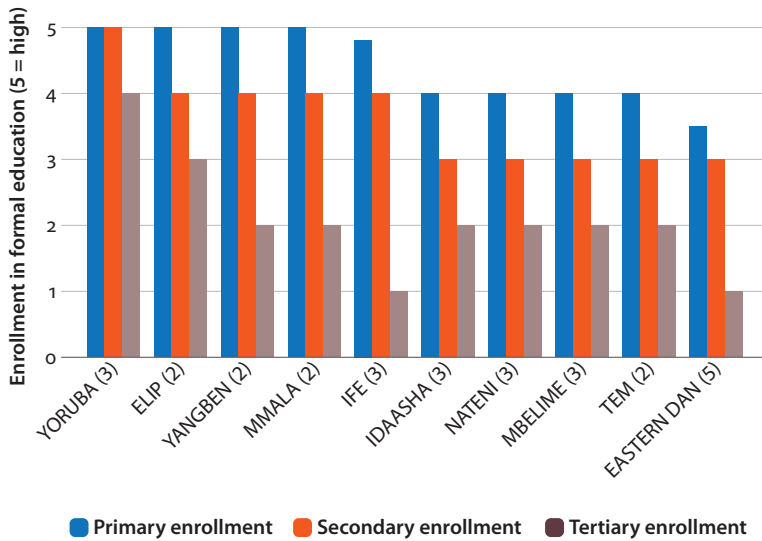


Figure 23. PRIMARY ENROLLMENT, SECONDARY ENROLLMENT and TERTIARY ENROLLMENT by FOCAL LANGUAGE

1. Few attend, very few complete
2. Some attend, few complete
3. Many attend, some complete
4. Most attend, many complete
5. Most attend and complete

Appendix 2, which list all the level 1 demographic variables and performance variables gathered during the experiments, can be found online:
<https://doi.org/10.1075/swll.18.additional>

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This book presents the results of a series of literacy experiments in ten Niger-Congo languages, representing four language families and spanning five countries. It asks the research question, “To what extent does full tone marking contribute to oral reading fluency, comprehension and writing accuracy, and does that contribution vary from language to language?”. One of the main findings is that the ethno-literacy profile of the language community and the social profile of the individual are stronger predictors of reading and writing performance than are the linguistic and orthographic profiles of the language. Our data also suggest that full tone marking may be more beneficial for less educated readers and those with less experience of L1 literacy. The book will bring practical help to linguists and literacy specialists in Africa and beyond who are helping to develop orthographies for tone languages. It will also be of interest to cognitive psychologists exploring the reading process, and researchers investigating writing systems.

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